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FIRE HAZARDS FROM GAS.

Leaking gas has lately caused a serious fire in the chambers of the United States Supreme Court in Washington. The accident occurred in an "absolutely fireproof" building—the National Capitol—constructed almost entirely of non-inflammable materials, yet valuable records and other documents are reported to have been burned.

A good deal is heard about the danger of what the newspapers call "electric wires." Is not this a very fair demonstration of the harmful possibilities that lurk in the homely gas-pipe? Given a leak and a light, the conditions are ripe for a disastrous explosion, followed by the burning of everything inflammable within range. This may well occur, as it has in this case, in a building as nearly fireproof as science can make it. Is it not time to prohibit the introduction of gas into such structures?

In a building meant to resist the chance of burning, gas is an ever-present menace. Mixed with air in proportions covering a wide range, it makes a dangerous explosive. A fire once started, it adds fuel to the flames. What is called a "combination fixture," or a combined gas and electric-light fixture, is a survival of the days when electric light was not always reliable. To-day it is as much an anachronism as the buttons on the back of our coats—survivals of the day when a man going on horseback buttoned his coat-tails up out of the way. Why should such a place as the Supreme Court chamber be piped for gas? If the conservatism that has retained gas-pipes since electricity has so abundantly shown its reliability were less in evidence it is probable that we would not have to read of the destruction of valuable papers and a considerable loss at Washington. Gas in a fireproof building is simply an invitation to disaster.

MULTI-TOOTH SINGLE-PHASE ALTERNATORS.

The distribution of the armature winding of alternators into two or more slots per pole and per phase has become quite common in the case of multiphase machines, in which its advantages are greater and more obvious than in the single-phase type. The pole-wound or unitooth single-phase machine is still that more generally built, although a full comprehension of the advantages of the other would undoubtedly induce a more general demand for the multi-tooth machine. The improved working of the latter is, however, gradually forcing it into more general use, single-phase machines now being built in this country with the winding distributed in as many as eight slots per pole.

The advantages of the multi-tooth or distributed winding are several. It gives a more nearly sinusoidal form to the impressed electromotive-force wave; it reduces the self-induction of the windings and consequently the internal drop, and particularly the drop on reactive load; it distributes the armature distortion, which, with the unitooth construction, causes a heavy bunching of the lines of force immediately ahead of the slot, increasing the iron loss in the pole pieces even if the latter are laminated, and it eliminates the pulsating variation of the reluctance of the magnetic circuit which is inherent with the unitooth type, and which increases the iron losses. These advantages are obtained at the cost of a greater expense in construction and a far greater necessary care in the insulation and a

somewhat reduced electromotive force per turn, since the distribution of the windings renders the electromotive force waves on the different slots somewhat out of phase with each other. In case of a uniform distribution over the whole pole angle, the effective electromotive force per turn is reduced by the distribution in the ratio of one to the average cosine of all angles between $\pi/2$ and $-\pi/2$, and since this average cosine is $2/\pi$, which is equal to about 0.637, the electromotive force in case of a uniform distribution is diminished about 35 per cent. The advantages, however, in case of a machine built to give satisfactory service as against one built to sell outweigh the disadvantages.

In the matter of winding this construction becomes quite simple for bar-wound single-conductor coils. The whole spiral of one pole angle may be form-wound, insulated and afterward driven into the slots, there being no necessity of bending down the ends except for the single connection between the exterior turn of one spiral and the interior of the next—that is, one bent end connection per pole. With wire-wound coils the problem is somewhat more difficult, but is simply solved with form-wound coils by making up a separate coil for every pair of slots.

THE ELECTRIC LIGHTING OF RAILROAD TRAINS.

Railway cars, especially parlor cars, are in this country almost universally lighted now by the Pintsch gas system, but the superiority in many respects of electric lighting maintains a steady attack on the various problems involved in the perfection of a suitable system for this service. While Pintsch gas gives a light far more satisfactory than that of oil lamps, and acetylene promises to excel Pintsch gas, the electric light is better yet, if a satisfactory service can be obtained, in that there is no combustion and consequently no danger of fire in case of accident. It lends itself admirably to the lavish decorative effects of modern palace cars, and it permits the use of that luxury in sleeping cars known as a berth light.

Granted that the electric is the best light, the demand for it will be a strong one, for, if there is one place where the best must be had at any price, it is in the equipment and furnishing of palace cars. The average middle-class American, no matter how simply he may live at home, demands as soon as he begins to travel the luxury of an Oriental potentate. That the electric light is considered the best is shown by the equipment of some of the most luxuriously furnished trains in this country, with a complete electric-lighting installation, in addition to the Pintsch equipment.* The latter is necessary when the train is divided or the locomotive uncoupled, as current is obtained from an isolated plant in the baggage car taking steam from the engine, but the electric equipment, with its cost of attendance, is regularly run solely to give the better light.

The methods of lighting trains or cars electrically are several, and a brief comparison of their relative merits may be of interest. One of the first developed was the provision under each car of a battery of accumulators capable of storing a night's charge, and arranged to be removed for recharging at the terminal stations. For cars running in regular service this system gives fair satisfaction, but for the ordinary roving palace car, which wanders from State to State according to the demand, it would require a system of charging stations as extensive as that of the Pintsch gas method, a system which it would be difficult to establish. The isolated-plant equipment in the forward coach supplied with steam from the locomotive, or better from a boiler in the same vehicle, is quite common and is sometimes combined with storage cells under the cars designed to be charged while the train is intact, and to feed the lights in their respective cars when they leave the main train to run to branch terminals. The sine qua non of a generally applicable system is a source of supply on each car independent of the rest of the train or of stationary charging plants. An independent engine on each car being out of the question, the most available source of power is the wheels themselves.

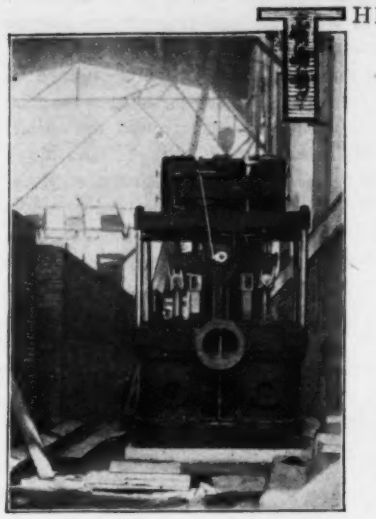
*See The Electrical World, November 6, 1897, page 561.

With axle-driven generators a storage battery is, of course, necessary to provide light when the train is standing or running below a certain critical speed. To eliminate the effect on the lamps of the difference in voltage when charging and discharging, two batteries are commonly used, one to be charging while the other is in use, but a great reduction in weight can be obtained by using one battery, alternately charging and discharging as the speed of the train varies. Such batteries to avoid, without complication, variations in the voltage and consequently in the candle power of the lights, must have a low resistance, small polarization and a high discharge rate, but their energy capacity need not be large. The problems to be solved are the provision of arrangements, first, for automatically maintaining the polarity of the current delivered with change of direction; second, for automatically cutting the dynamo into and out of circuit at speeds respectively above and below a certain minimum generating limit, and third, for automatically maintaining constant the voltage generated over a wide range of speed. The first problem is readily solved mechanically; the second can be met by a switch operated either by centrifugal weights or by an electromagnet dependent on the voltage of the dynamo; but the third is a more difficult one. One rather unscientific makeshift is the use of belts which slip when the speed or load becomes too great. This involves a considerable loss of power, and, what is worse, serious heating and wear of the slipping parts. Other systems vary the field strength inversely with the speed, thus maintaining constant voltage by means of automatic rheostats, magnets, springs, escapements, ratchets and other things which are objectionable in this sort of service.

The only known method of obtaining practically constant voltage with highly variable speed and without troublesome devices, and one which seems to have been neglected in spite of the great advantages which it would possess in storage-battery charging, is as follows: The use of a dynamo with a flat-topped characteristic with shunt exciting coils of magnetomotive force sufficient at the storage-battery voltage to carry the magnetization well above the bend of the curve, and with field coils in series with the armature tending—when the machine generates current—to oppose the shunt excitation. With such an arrangement small outputs through the series coils would not materially lower the voltage, but in case the speed rises, tending to increase the output, and the excitation falls below the bend of the magnetization curve, any further increase of the load would materially diminish the field density and consequently the voltage. With proper design such a machine could be made to run over a wide range of speed with a small change of output at constant pressure if delivering to a storage battery. The latter would, of course, maintain the stability of voltage otherwise unattainable with shunt machines or under-saturated fields, and would absorb the variations in load necessary to the differential compounding. The series coil, instead of reducing the equilibrium of voltage between the machine and battery, as with ordinary compound generators, would tend, with this reverse action, to increase it.

With any system of field density inversely proportional to the speed, the armature reaction with constant load becomes a troublesome factor at the high speeds and consequent weak fields, but there are now several well-known methods of obtaining a proper commutation with variable field strength, so that this difficulty is probably not a serious one.

The New Generating Station of the Boston Electric Light Company.

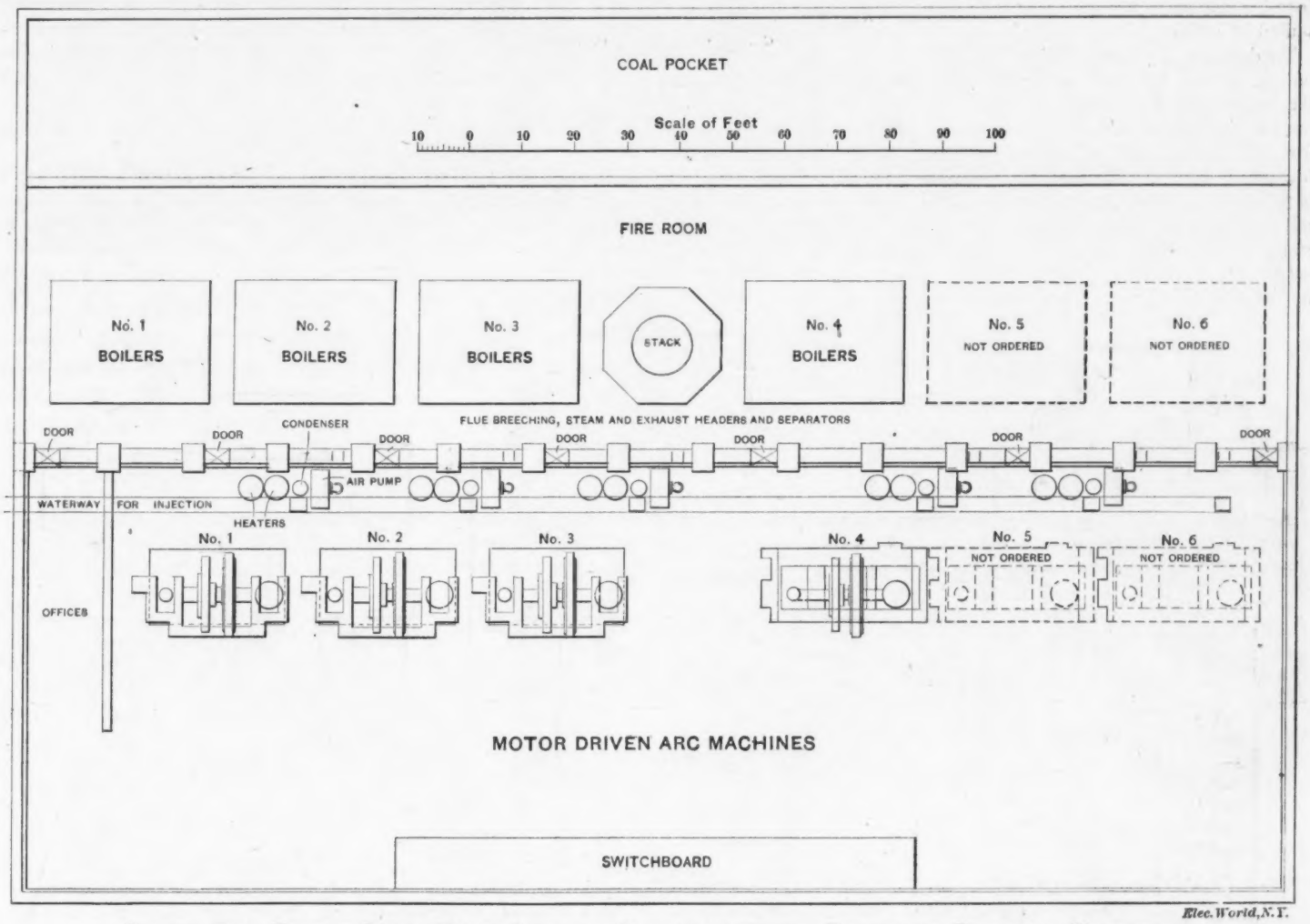


THE Boston Electric Light Company has one of those systems which have been in operation with alternating-current apparatus from the early days, and consequently is under conditions most perplexing to its management in the matter of bringing the installation up to date. The developments in this particular line have been so great and the apparatus in use has become obsolete so much more rapidly than it has depreciated mechanically that satisfactory operation with low running expenses requires practically the throwing of much serviceable equipment in the scrap heap and the purchase of new, with a corresponding increase of the fixed charges. If this were all the trouble it would be a simple matter, as the increased fixed charges and the reduced operating expenses can be reckoned quite closely and balanced against each other, but alternating-current machinery is still developing, and it is hard to tell what old apparatus to keep in service until systems and machines have been further standardized and improved.

The Boston Electric Light Company, like many another throughout the country, has just gotten rid of the last of its motors on arc light circuits, and now operates a considerable load of 500-volt direct-current motors, taking about 1000 kw at the peak of the curve, which system is rather an incongruity on alternating-current work, but cannot be replaced immediately by alternating-current motors, owing to their private ownership. The company's officers, President F. A. Gilbert and the engineers, have made a careful study of the problem, and their conclusions, as embodied in the system now in course of construction and described below, will be of no little interest to the officers of the many other companies similarly situated.

The system now consists of four generating stations, with the usual combination of varied types, sizes and speeds of engines belted to series arc machines, and small alternators running independently on their individual loads, with 500-volt direct-current generators for the motor loads. The distributing system consists of the usual multiplicity of single-conductor cables, with manhole transformers of quite large sizes, running up to 30 kw grouped on primary mains with three-wire 220-volt secondaries, each transformer feeding its own district, the secondaries not being cross-connected. The immediate cause of the remodeling of the system was the building of the new Southern Union Terminal Railway station in Boston, which necessitated the rearrangement of the streets, one of which cuts off the coaling pocket and bunkers of the Congress Street station.

The new central generating station, which is now under roof, and by the time this article is read will probably have steam on one battery of boilers and one generator, is built in South Boston on a plot of ground of 13 acres, formerly occupied by the historic Harrison Loring shipyard, wherein were built many famous craft. This 13 acres has a water frontage, and in fact a large part of it is under water, but will be made useful for and by the dumping of the ashes from the station. The station is laid out structurally on the usual plan, consisting of two main rooms separated by a fire wall, each roofed by steel trusses extensible at one end, one the boiler and the other the machine room, the external dimensions of the whole being 244 by 174 feet. The general layout of the structure is shown in the accompanying plan. The boiler-room roof spans also the mammoth coal pocket, which runs the whole length of the boiler-room on the side opposite to the machine-room, and is separated from the boiler-room by a wall, which, as it does not support

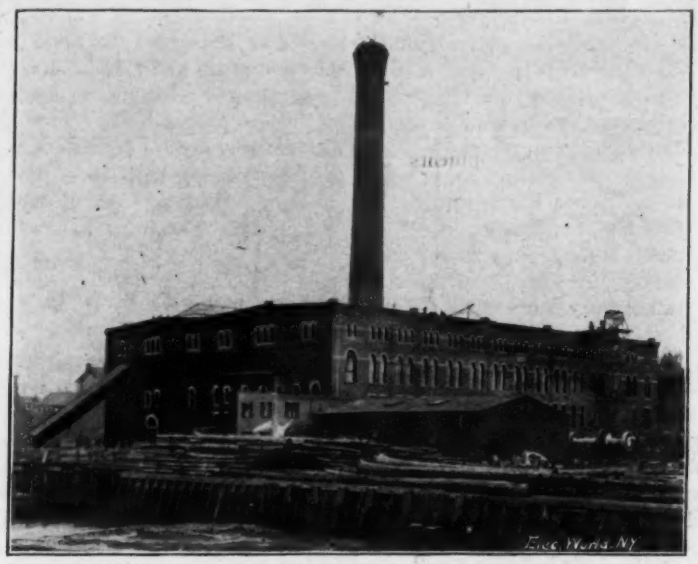


Elec. World, N. Y.

GENERAL PLAN VIEW OF POWER PLANT, OUTLINING POSITION OF ENGINES, BOILERS AND ELECTRICAL MACHINERY.

the roof span, may at some future time be taken down, allowing the coal-pocket space to be occupied by another row of boilers facing the same fire-room as those now under construction. This one fire-room is ample for the two rows of batteries, as the width is determined by the space necessary for the drawing of the boiler tubes, which may be drawn from either side into the same area.

The engine-room will eventually contain one row of six generators adjacent to the boiler-room, of which four have been ordered, the other half being filled with the auxiliary transforming machinery described below, which at some future time it is expected may be displaced by the consolidation of the various services of the system, giving room for another similar row of main machines. Thus, with the endwise extension of the station to double its present length, its capacity will be increased fourfold, the present arrangement giving room for six units and six boiler batteries, with an aggregate rated output of 9000 kw, of which four sets, aggregating 6000-kw capacity, are to be installed at once.

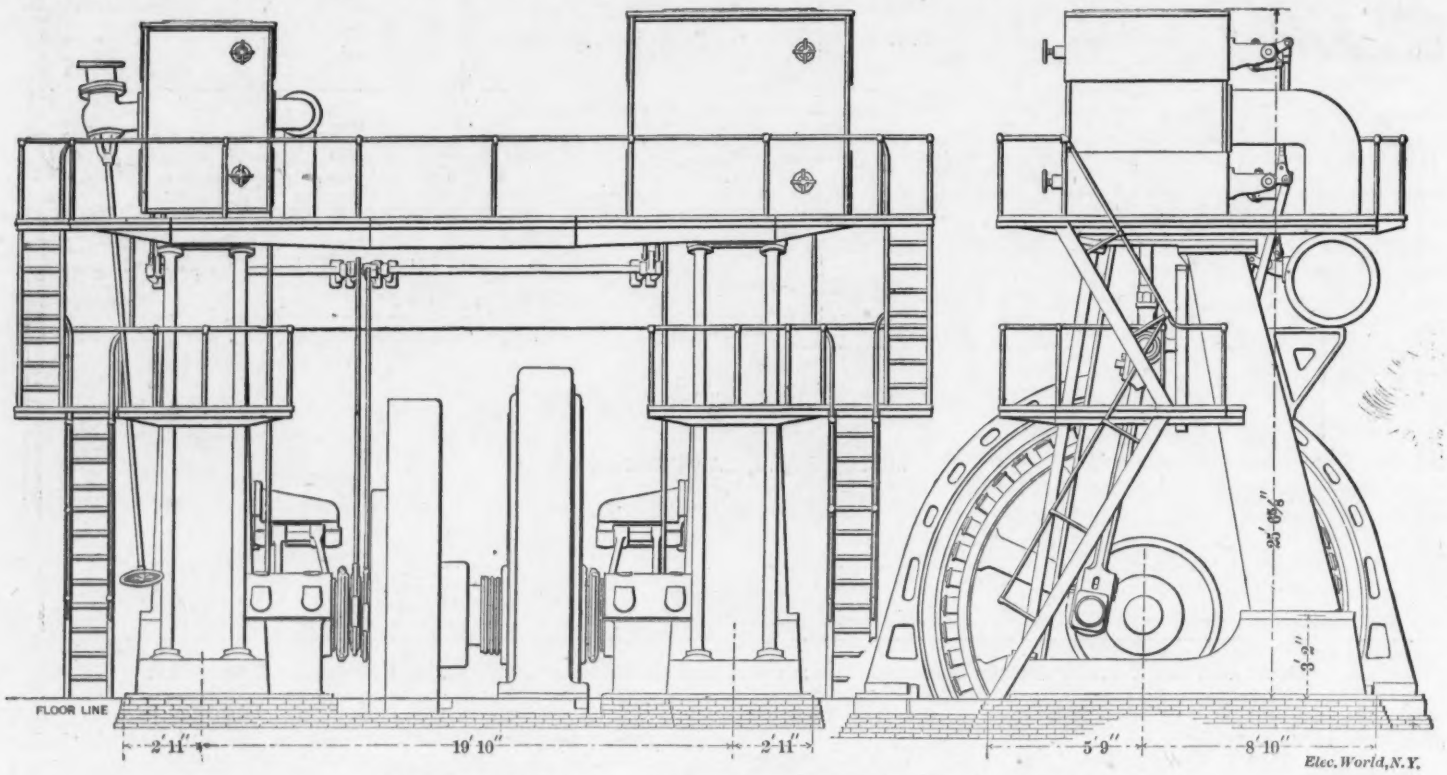


The Exterior of the Station on August 24, Showing Incline of Coal Conveyor.

To describe the system in detail it would be well to begin with the wharf arrangements for receiving the coal. A long pier has been built, carrying a moving tower or crane, which has a travel of 150 feet, for manipulating the unloading buckets into the hatches of canal boats or other craft used in bringing in coal. From here it is taken by a conveyor, built by the C. W. Hunt Company, horizontally and up an incline (see the accompanying illustration) to the run over the mammoth coal pocket, which will have a capacity of 9000 tons, its dimensions being 240 feet in length by 30 feet in width by 50 feet in height. This pocket is built up with rolled steel I-beam columns, the brick walls being arched, with the convex side inward, to withstand the bulging pressure of the coal within. The indoor flanges of each alternate I-beam are gripped by cast iron segments, giving a vertical flue with an opening every few feet to ventilate the coal. The floor of the pocket is about 10 feet above the boiler-room level. Chutes discharge into the boiler-room from the lower edge of the pocket on that side and empty into coal cars, which will be run onto scales and weighed, and from there moved to the boiler fronts. The tracks also extend to hoppers under the floor of the pocket by which the coal below the normal surface of inclination to the chutes may be withdrawn without shoveling. The greater part of the coal, however, can be taken out through the chutes, the conveying apparatus overhead dumping quite close to the boiler-room side. Ashes will be handled on the boiler-room floor with cars to carry them to the district to be filled.

The water-tube boilers are of the Babcock & Wilcox manufacture, triple drum, of a nominal output of 500 horse-power each on the Centennial rating, grouped two in a battery, this giving each battery a rated evaporative capacity of 30,000 pounds per hour, sufficient for each generator, which is rated at 2350 horse-power, with a guaranteed consumption of 12½ pounds of water per hp-hour. The boilers are fitted with Hawley down-draft furnaces, and will run at 160 pounds presure. The four batteries now under erection are in a row down one side of the fire-room, which is well lighted by a glass monitor, the boilers having their backs to the engine-room wall.

Between the two centre batteries will rise the mammoth brick stack, which, 225 feet in height, with an 11-foot bore, and with an octagonal base 22 feet between faces at the boiler-room level, is founded on a grillwork of I-beams laid in concrete—19 feet deep—on the gravel and clay substratum. The building has no piling whatever; quicksand was struck under some of the foundations for engines, but was dug out, and the solid substratum was reached at a depth of about 9 feet. The chimney is capped with cast iron segments 6 by 4 feet in size, ⅜ inch in thickness, and with flanges by which they are bolted together, the iron weighing in all about 7

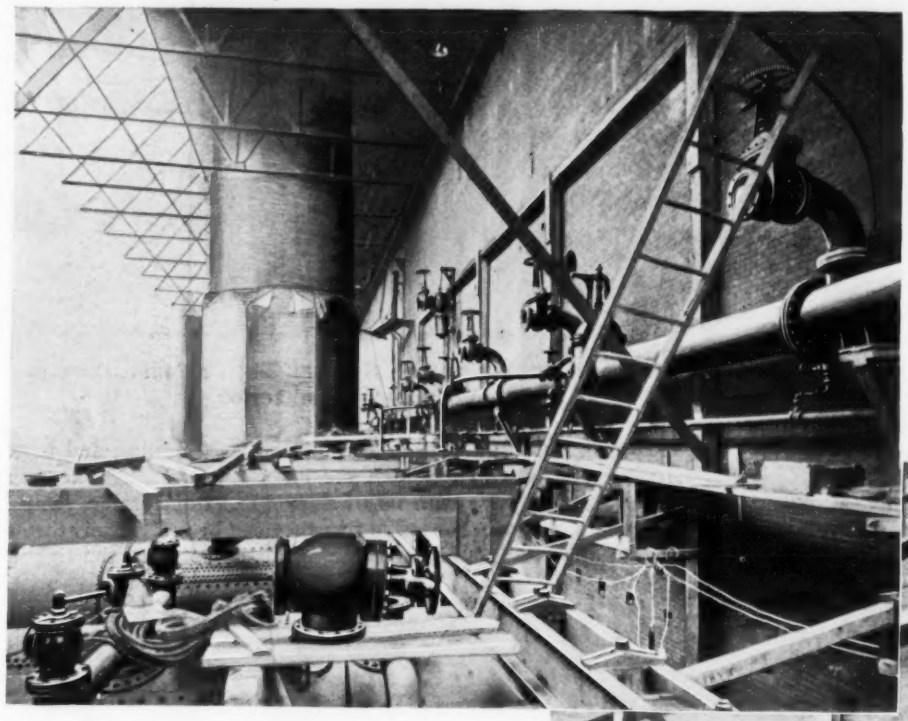


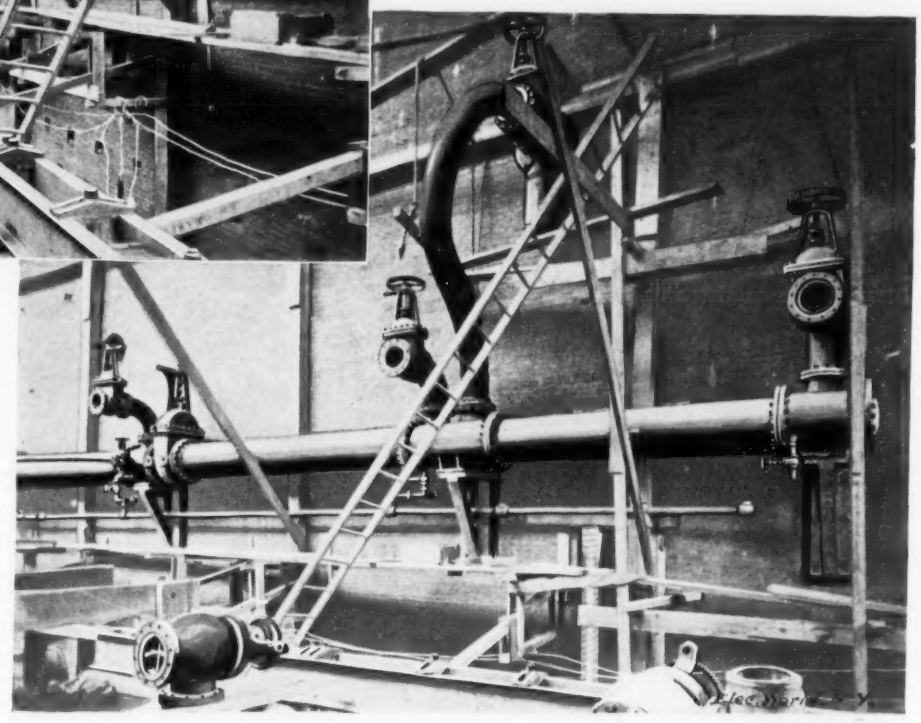
Front and Side Elevations of One of the Generating Units.

tons, and being capped with a lead ring. The flue gases reach the chimney through breeching behind the boilers, more properly termed a chamber, on account of its large size and the fact that it is of brick. The floor of this chamber is of steel girders, with brick arches.

Steam is taken from the boilers through nozzles rising vertically to a height of 10 feet, with elbow valves at their tops geared down to handles at the floor level. These steam taps drop vertically into the 20-inch header which runs the length of the boiler-room above the flues. Springing from the header immediately beside each boiler inlet is the engine outlet, and the header may be thrown entirely out of service by gates at either side of each combined inlet and outlet, giving each engine an independent steam supply from its own battery of boilers. The engine outlet curves over and into a Cochrane separator, also on the boiler-room side of the wall, the outlet from which passes straight through the wall and to the engine stop-valve. (See illustrations of piping connections presented on this page.) The engine exhaust comes straight back through the boiler-room wall at a little lower level to an atmosphere exhaust header. On the engine-room side of the wall each exhaust branches downwardly to a jet condenser, on the way to which it pases through an exhaust feed-water heater, made by the National Pipe Bending Company, a similar heater for live steam being installed beside it. Feed-water will be taken from the city mains, this expense being considered less than the boiler deterioration due to the oily feed from surface condensers. Running in from the harbor is a sluiceway 7 feet in height and 4 feet in width for the suction of the condensers, which discharge into a 36-inch pipe running out under the boiler-room. The engine-room, 240 by 82 feet in size, has walls built entirely of glazed brick up to the crane-ways, a height of 52 feet above engine-room floor. (See illustration presented on page 526.) Below it is a 9-foot basement, taking from the room all of the wiring and most of the piping. In a straight row on the side next to the boiler-room wall, with the shafts running lengthwise of the room, will be four vertical cross-compound McIntosh & Seymour engines with overhung cranks and alternating-current generators hung between the two main journals. These machines, as stated above, are rated at 2350 horse-power, with a guarantee at this load of 12½ pounds of steam per hp-hour at 160 pounds pressure condensing, and run at 120 r. p. m. This rating is based on a 23 per cent. cut-off, giving a large overload margin, the maximum cut-off obtainable with the valve gear being 75 per cent. of the stroke. The piston speed, since the stroke is 4 feet, is 960 feet per minute, a rather high figure for engines of this size, but rendered necessary by the direct connection of dynamos of the size and frequency employed. The engines are of the open-front marine type, provided each with a 50-ton, 16-foot fly-wheel, with a remarkably large hub, within which is contained the shaft governor. To give the proper speed control of these engines in synchronizing—that is, to bring any newly started engine running light down to the speed of its mates running loaded, in order to throw the machines in parallel—the governor is fitted with a hand speed-varying device, which operates on the weights through collars on the shaft. The engines are guaranteed to give a 1½ per cent. speed regulation between no load and full load, and also, on account of the fact that the generators are to be operated in parallel and are to run synchronous motors, the engines are guaranteed to give a very small variation in the speed during a rotation. The cranks are set at quarters, and the guarantee is that the maximum variation in angular position throughout the revolution from the mean position of absolute uniformity of rotation shall be one-tenth of one degree, or 1-3600 of one rotation—that is, the total change of angular position as compared with that of absolute uniformity of motion shall be two-tenths of one degree. The engines are very substantially built to give smooth running in spite of the high speed, the most interesting dimensions being those of the main bearings, which are each 21 inches in diameter by 42 inches in length, the shaft being forged to 26 inches between journals. Each crank pin is 10½ inches in diameter by the same dimensions in length, the crosshead pin having the same length, and 9½ inches diameter.

The valves are of the grid-iron plate type, multiported, traveling across the engine in the cylinder heads. The cut-off is effected by auxiliary grid-iron plates traveling on the backs of the main valves and driven by the shaft governor.





VIEWS SHOWING PIPING CONNECTIONS BETWEEN BOILERS AND ENGINES.

Underhung beside the fly-wheel is the revolving field of a General Electric three-phase, 1500-kw, 60-cycle generator, guaranteed to carry a 50 per cent. overload for three hours and a 30 per cent. overload indefinitely, the machine being necessarily rated light on account of the regulation guarantee, which is 5 per cent. The diameter at the air gap is 16 feet, the number of poles on the rotating field being sixty. The machines will generate the line pressure of 2250 volts direct between corners of the delta connection. The armatures have two slots per pole per phase, each three-quarters of an inch wide and 2⅛ inches deep. They are coil-wound, with two turns per coil and the elements of two coils in each slot.

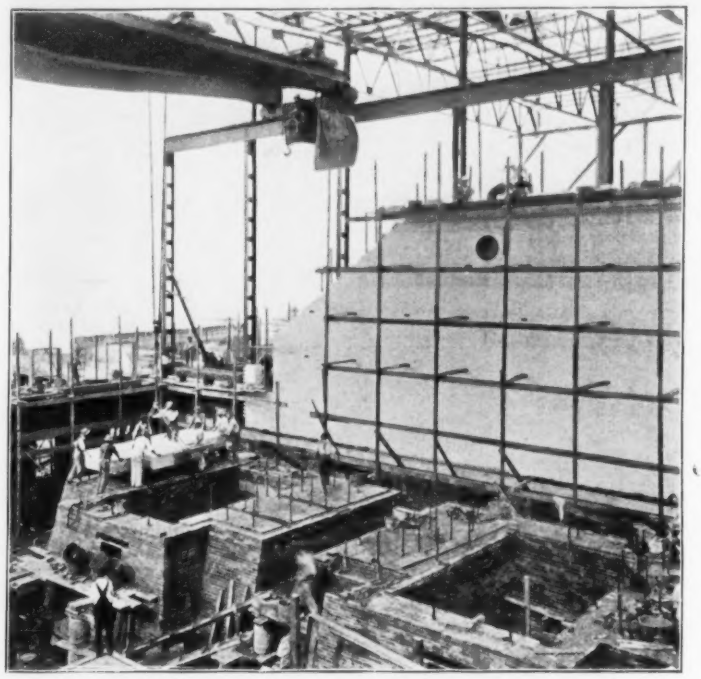
The main switches will be mounted on the engine foundations,

and will be pneumatically controlled from the switchboard. The leads to the switchboard pass through vitrified conduits buried under the tiling in the concrete covering the steel-beam and double-brick arch floor construction. The switchboard, 100 feet in length, runs along the wall of the engine-room opposite the fire-room, and will be double-decked, a gallery 11 feet above the engine-room floor carying the machine panels and all the outgoing lighting feeders, the lower deck carrying the arc-light circuits and the controlling circuits of the motors mentioned below. The most remarkable feature of the switchboard is the use of aluminum bus bars, which will be mounted on a separate marble board under the gallery. They will have bolted connections throughout, large surfaces being provided, the joint being covered with shellac or some other substance to prevent corrosion.

Besides the four main steam engines there will be but one other steam engine in the station. This will drive one of the three exciters, the other two being driven by synchronous alternating-current motors. Three Goulds triplex boiler-feed pumps with double-reduction gears will also be driven by the same type of motors and fitted with by-pass valves to obtain variations in feed, and various auxiliary apparatus, such as the coal conveyors, etc., will also be motor-driven, only the Blake twin vertical air pump being steam-driven. Twenty 150-kw General Electric synchronous motors will be coupled each to two 160-light Brush multi-circuit arc machines, giving 7 amperes for the new enclosed arc lights which the company is now building in its own shops to replace the 10-ampere open arcs. This collection of sixty machines will be mounted on the heavy steel girder and brick arch floor, each set of three machines being on wooden bases to give them insulation from the ground.

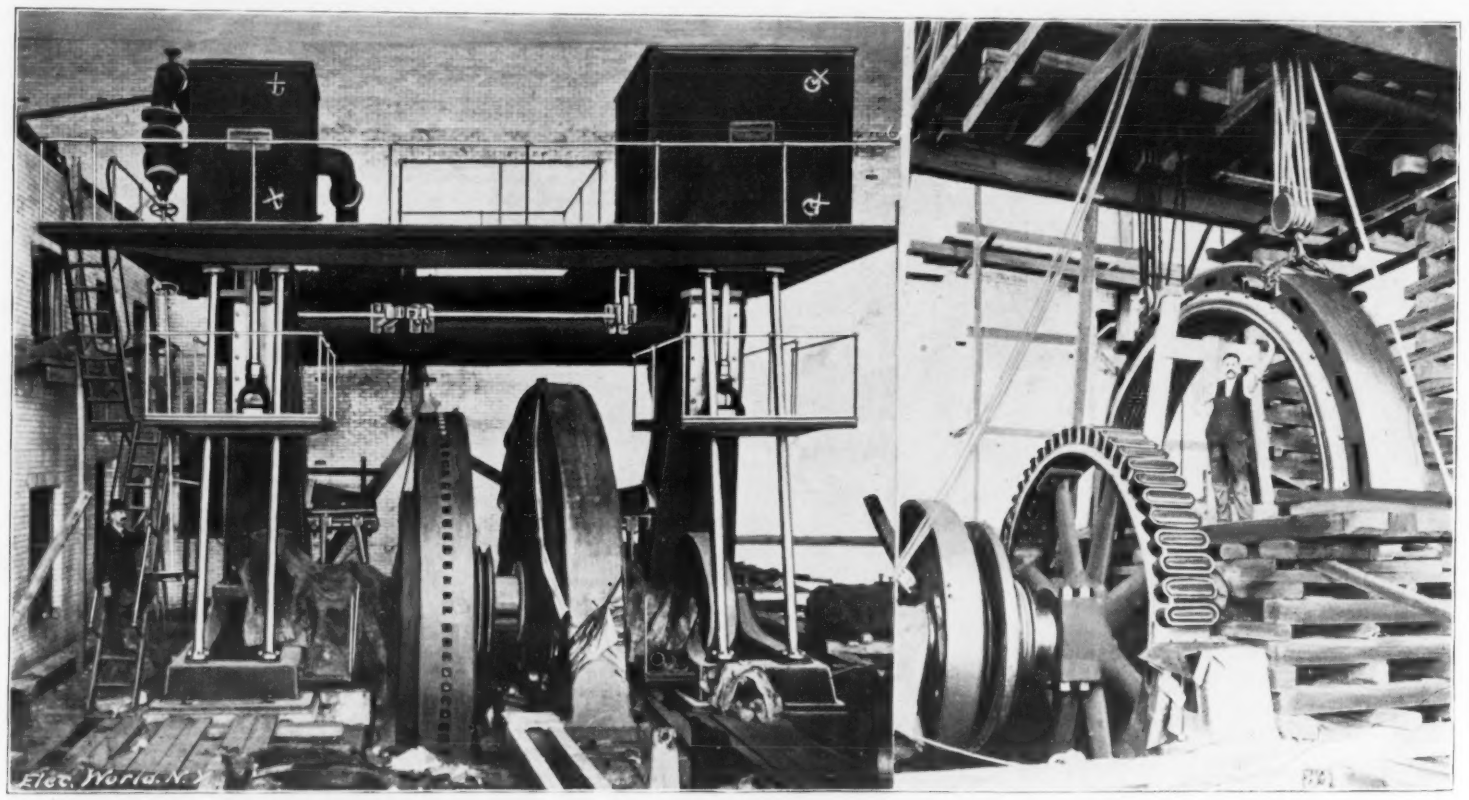
One 180-kw synchronous motor is also coupled to a 150-kw, 500-volt generator for carrying the night power load direct from the station, which load will be carried by a rotary transformer sub-station by day. Also coupled to the same pair is a 150-kw single-phase alternator to carry any feeder or feeders which may have a ground on one side. This is a novelty in central station work, but is apparently based on a serious weakness of alternating-current working. In large underground systems, worked as this one will be, on a single set of bus bars, there is a large capacity in the 2000-volt primaries sufficient to give considerable trouble from capacity currents through any ground or partial ground, often breaking down the insulation in the manholes or conduits by the heating effect and causing a serious burnout. By isolating grounded feeders on electrically separated circuits, either by means of stationary transformers or motor-driven machines, this trouble can be avoided.

Over one end of the engine-room will be the offices, and above them will be a repair shop with a hatchway in its roof, into which the grab of the 25-ton traveling crane can be lowered. This crane is motor-driven, and is now in use with current derived from the existing stations for handling the apparatus as it is installed.



Engine-room on July 20, Showing Engine Foundations in Course of Construction.

The distributing system will be divided into lighting and motor circuits, the former single and the latter three-phase. The many lighting feeders, each with its own group of transformers, will be arranged on the switchboard so that they can be individually thrown between any two of the three-phase buses, so that the lighting load can be at all times balanced by the switchboard attendant. The motor-load will also have no effect on the drop in the lighting mains or secondaries. The current will run to the city, about 1½ miles distant, via two double conduits over separate routes, each



October 17. Views of One of the Generating Units in Course of Erection. September 17.

double conduit having twenty-four ducts, twelve of which pass through manholes distinct from those of the other twelve. The submarine conduit for bringing one of these lines into the city was described and illustrated in THE ELECTRICAL WORLD of October 29, 1898.

To lay out a system of this magnitude, with all the changes from high-frequency single-phase to a lower frequency multiphase, to provide for the gradual replacement of direct-current motors by those of the alternating variety, and to construct one station to carry continuously the whole load, is a problem in which slight errors would mean very serious consequences. The solution of these difficulties adopted by the officers mentioned above reflects no little credit on their engineering abilities.

Mr. Tesla's Application of Hertz-Wave Transmission.

Exercising their well-developed ability to make a startling piece of news of a very ordinary event, the daily papers have taken up Mr. Nikola Tesla's recent patent, No. 613,809, issued November 8, 1898, and made of it "the greatest marvel of the age." The facts, as set forth in the patent cited, are in brief as follows: Hitherto the only practical means of controlling the movements of a vessel,

A VIEW OF THE COAL POCKET, BOSTON ELECTRIC LIGHT COMPANY'S GENERATING STATION, ON AUGUST 24.

such as a torpedo or a torpedo boat, at a distance has been the use of a cable, the disadvantages of which are obvious. The plan proposed by the inventor is to provide any such craft with a coherer connected between the hull and an elevated terminal and to so arrange the propelling and steering mechanism, which is motor-driven with storage-battery supply, that it can be controlled by various relays and auxiliary devices actuated through the agency of the Hertz waves.

A single coherer is used, the inventor preferring this to a plurality of coherers respectively syntonized to respond to waves of different frequency, although he states that he has "demonstrated the practicability of providing a great number of such receiving circuits—50 or 100 or more—each of which may be called up or brought into action when desired, without the others being interfered with." This coherer possesses some elements of novelty designed to yield a more uniform de-cohering action. It consists of a metal cylinder with insulating ends and a metal rod passing lengthwise through it. The cylinder normally stands with its axis vertical, and the de-cohering action consists of inverting it, throwing the granules or particles, which, according to the illustration, occupy about one-fifth of its length, from one end to the other. The patent also describes these granules as "manufactured by a special tool, insuring their equality in size, weight and shape, and uniformly oxidized by placing them for a given time in an acid solution of pre-determined strength. This secures equal conductivity of their surfaces and stops their further deterioration, thus preventing a change in the character of the gas in the space in which they are enclosed. I prefer not to rarefy the atmosphere within the sensitive device, as this has an effect of rendering the former less constant in regard to its dielectric properties, but merely secure a water-tight enclosure of the particles and rigorous absence of moisture, which is fatal to satisfactory working."

The auxiliary devices consist of ordinary relays, actuating a simple step-by-step escapement wheel, which in turn rotates brushes and commutators, affecting the various internal circuits of the boat. These differ in no essential respect from the rosettes or circuit controllers of synchronous printing-telegraph instruments, and many other means of accomplishing the same results by a different arrangement of details could, of course, be devised. There is apparently nothing broadly new in this part of the invention. The claims upon it, however, are very broad, the first claim reading as follows: "The improvement in the art of controlling the movements and operation of a vessel or vehicle herein described, which consists in producing waves or disturbances, which are conveyed to the vessel by the natural media, actuating thereby suitable apparatus on the vessel and effecting the control of the propelling engine, the steering and other mechanism by the operation of the said apparatus, as set forth." It is doubtful if this claim would withstand litigation in case of infringement, if it ever became possible to make such a system operative, as it is simply the use of the coherer as a relay for actuating a step-by-step mechanism, instead of a simple sounder. It is obvious that, unless Mr. Tesla has made revolutionary improvements in Hertz-wave apparatus which have not yet been disclosed, the coherer and auxiliary apparatus working therewith are altogether too delicate for the service proposed.

Mr. Tesla is quoted by the daily press in this connection as follows:

"War will cease to be possible when all the world knows that the most feeble of the nations can supply itself immediately with a weapon which will render its coast secure and its ports impregnable to the assaults of the united armadas of the world. Battleships will cease to be built, and the mightiest armorclads and the most tremendous artillery afloat will be of no more use than so much scrap iron. And this irresistible power can be exerted at any distance by an agency of so delicate, so impalpable a quality that I feel that I am justified in predicting that the time will come, incredible as it may seem, when it can be called into action by the mere exercise of the human will.

"My imagination fairly reels when I attempt to contemplate its countless possibilities. Already I hear the knell of the battleship and the monster gun. Their day has passed with the advent of a new and irresistible power, which gives to all nations an absolute power of defense against any attack.

"England has until now boasted of her mastery of the seas, but her superiority has vanished and she is now no stronger than the weakest of the maritime nations, so far as her offensive power is concerned. England, who is now so diligently preparing for war, will awake to this unwelcome discovery to-morrow and will be utterly confounded; and France, against whom her armaments have been reported to be preparing, will rejoice in the discovery that she possesses an all-powerful weapon of defense.

* * * * * *

"But I have no desire that my fame should rest on the invention of a merely destructive device, no matter how terrible. I prefer to be remembered as the inventor who succeeded in abolishing war. That will be my highest pride. But there are many peaceful uses to which my invention can be put, conspicuously that of rescuing the shipwrecked.

"It will be perfectly feasible to equip our life-saving stations with life cars, or life boats, directed and controlled from the shore, which will approach stranded vessels and bring off the passengers and crews without risking the lives of the brave fellows who are now forced to fight their way to the rescue through the raging surf. It may also be used for the propulsion of pilot boats, for carrying letters or provisions or instruments to inaccessible regions, for killing whales and for many other commercial or scientific purposes.

"In order to give a practical illustration of this it is my intention to exhibit a model of a torpedo boat at the Paris Exposition and direct all its movements from my office in New York." * * *

It is probable that the movements will be directed by messages sent via the transatlantic cables; otherwise we would advise the use of the torpedo boat and its directing mechanism for trans-oceanic telegraphy.

Some French Electrical Machinery.

In spite of the close intercommunication between America and Europe in the matter of technical and scientific developments, the apparatus devised in one country often differs quite radically from that in the other, owing perhaps to differences in taste and judgment, the outgrowth of racial characteristics. Particularly in the line of electrical machinery is this true, as its development has been so rapid that designers have gone ahead in each country on their own lines with hardly time to examine the work of their confrères speaking a different tongue, and, in spite of the publicity given by the technical journals, the engineering societies and books published on the subject, the designs of apparatus for the same purpose differ not only in details, but even sometimes in the principles involved. A study of the apparatus built in other lands is thus likely to be more profitable than that of the home product and should be encouraged in that it tends to suggest modifications, many of which may be improvements.

The product manufactured by Fabius Henrion, Nancy, France, who manufactures perhaps the most comprehensive line of electrical apparatus in the world, certainly far surpassing that of any one establishment in America, gives a most excellent opportunity to compare well recognized standard French designs with those of this country. The following details and illustrations of this machinery have been selected on the score of their interest, owing to the differences they show from American standards.

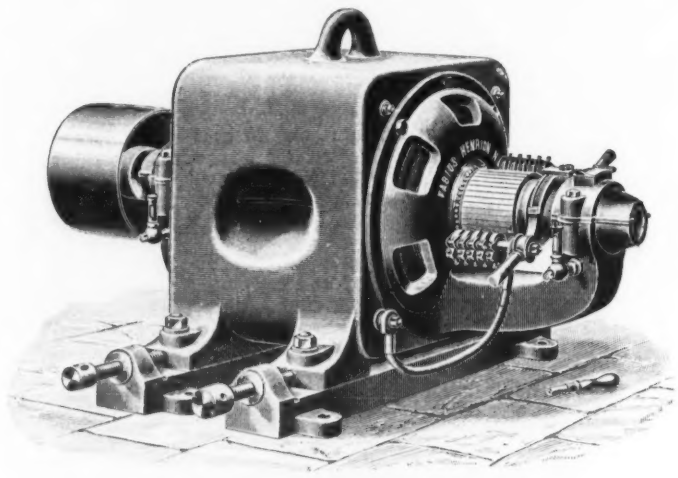


Fig. 1.

DIRECT-CURRENT MACHINES.

This French establishment manufactures in general three types of direct-current dynamos. In the line of constant-potential machines, the smaller sizes, that is, those up to 25-hp capacity, are bipolar, with a rectangular enclosing yoke of the magnetic circuit and bearings mounted on extensions of circular end plates bolted to this yoke. The field magnet is one single iron casting with no joints whatever from pole to pole. The iron is hollowed out over each pole, as may be seen by the illustration, Fig. 1, and slotted in the middle of the pole, both these details being for the purpose of minimizing the distortion of the field by the cross-magnetizing effect of the armature. The latter is drum-wound, with a core made up of laminations varnished and also separated from each other by thin parchment-like paper, and with no ventilating ducts or spaces.

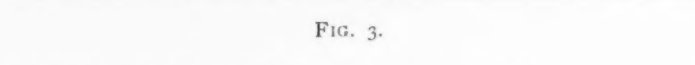


Fig. 3.

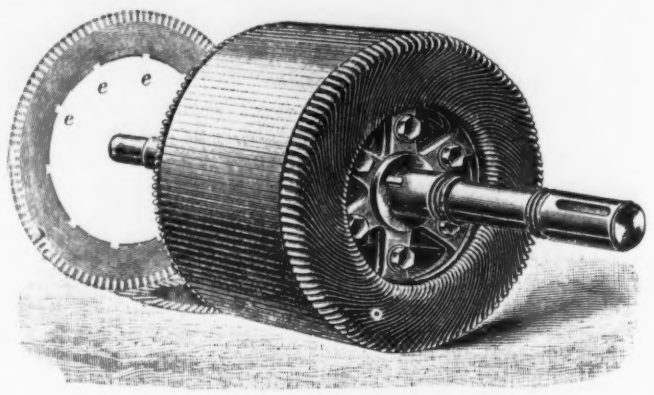


Fig. 2.

The teeth are T-shaped, with very narrow openings into the slots, as shown in the illustration, Fig. 2, although some machines are made with form-wound coils. The end connections are of the plain spiral variety.

The commutators are made large for the use of carbon brushes, the segments being of drop-forged copper, but differing from American practice in that the ends are not tapered to give a tight centripetal force in assembling. Two iron clamping rings, shown in Fig. 3, surround the straight projections of these segments, and this is claimed to be a great improvement over the conical devices. In the large machines the armature leads are soldered into the segments, and in the small machines screwed on. The carbon or graphite brush of an odd trapezoidal cross section is shown in Fig. 4, the smaller parallel plane bearing on the commutator. These brushes are electrolytically coated with copper and mounted in holders pivoted on brush-holder studs, about which they are rotated against the commutator face by leaf springs.

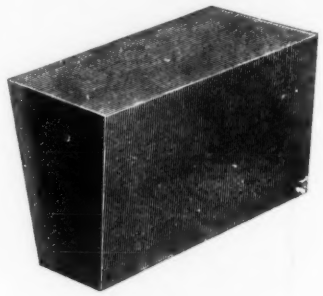


Fig. 4.

The bearings of these dynamos are of a very ingenious self-oiling and self-filtering type, well known in France as the design of Fabius Henrion, but differing from anything known in this country. As shown in Fig. 5 the shaft *A* carries loosely a ring *B*, considerably larger than itself, dipping into a tank of oil *K*. The ring is provided with small holes to carry up the oil without throwing it off by centrifugal action. The oil leaves the journal at the end of the brasses, where it falls into a compartment separated from that in which the ring dips by two filters, through which it must pass to complete the circulation. The outward services of these filters incline in such a way that impurities caught thereon tend to fall into the bottom of the chamber, which is partly filled with water, the oil floating on the top of the water. This gives a continuous circulation with a

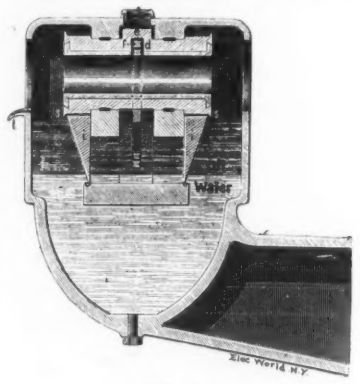


Fig. 5.

filtration of the oil every time it passes through the journal, making of each bearing a complete oil filtering and circulating system.

The larger machines, those above 25-hp capacity, are multipolar, with a similar arrangement of the fields to save weight and reduce the magnetic distortion. Fig. 6 shows a handsome design of belted generator with under-hung pulley. The brush holders are mounted on a ring at the outboard end of the commutator, a practice that has been largely abandoned in this country. Another detail that strikes the American eye is the casting of the lifting ring in one piece with the upper half of the field yoke.

The third type of direct-current machinery is a classical French style, with smooth body armatures and radial active windings, such as that shown in a multipolar form in Fig. 7. This machine requires a short disc-like armature, cylindrical laminations, a very long shaft between bearings and many other peculiar features which have kept it out of American use, but it still seems to be favored by the French. An odd bipolar modification of the same machine, with a U-shaped yoke around the shaft at either end, is that shown in Fig. 8, and is used for constant-current series arc-light work, the regulation being obtained by varying the position of the brushes and thereby the reaction of the armature by means of a relay and magnetic pawl and ratchet-wheel governor, which is described below.

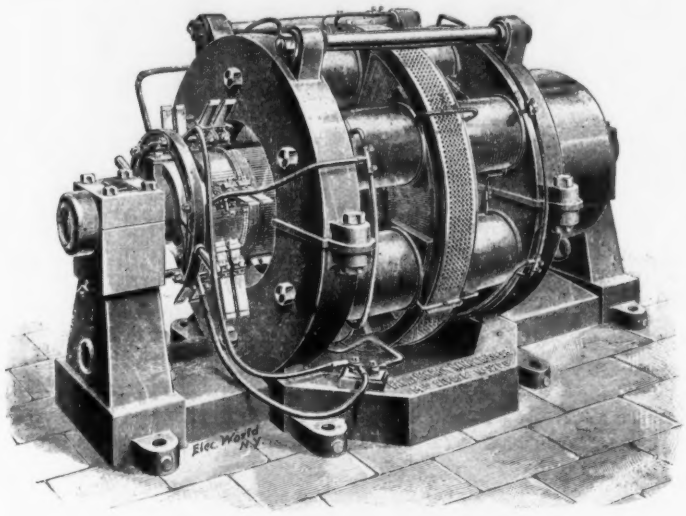


FIG. 7.

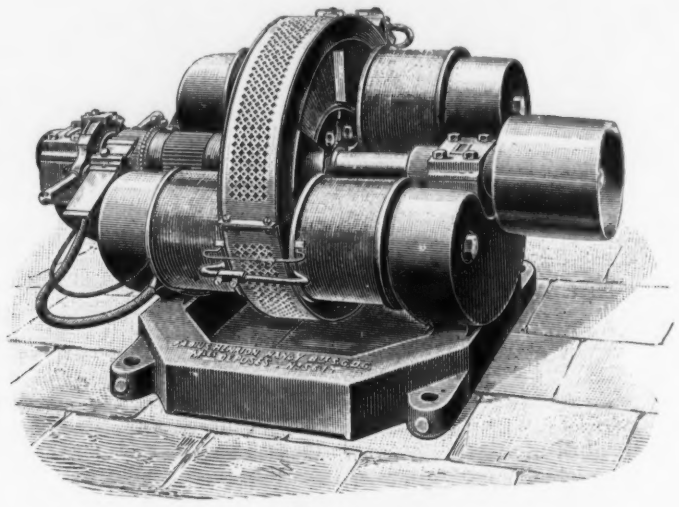


FIG. 8.

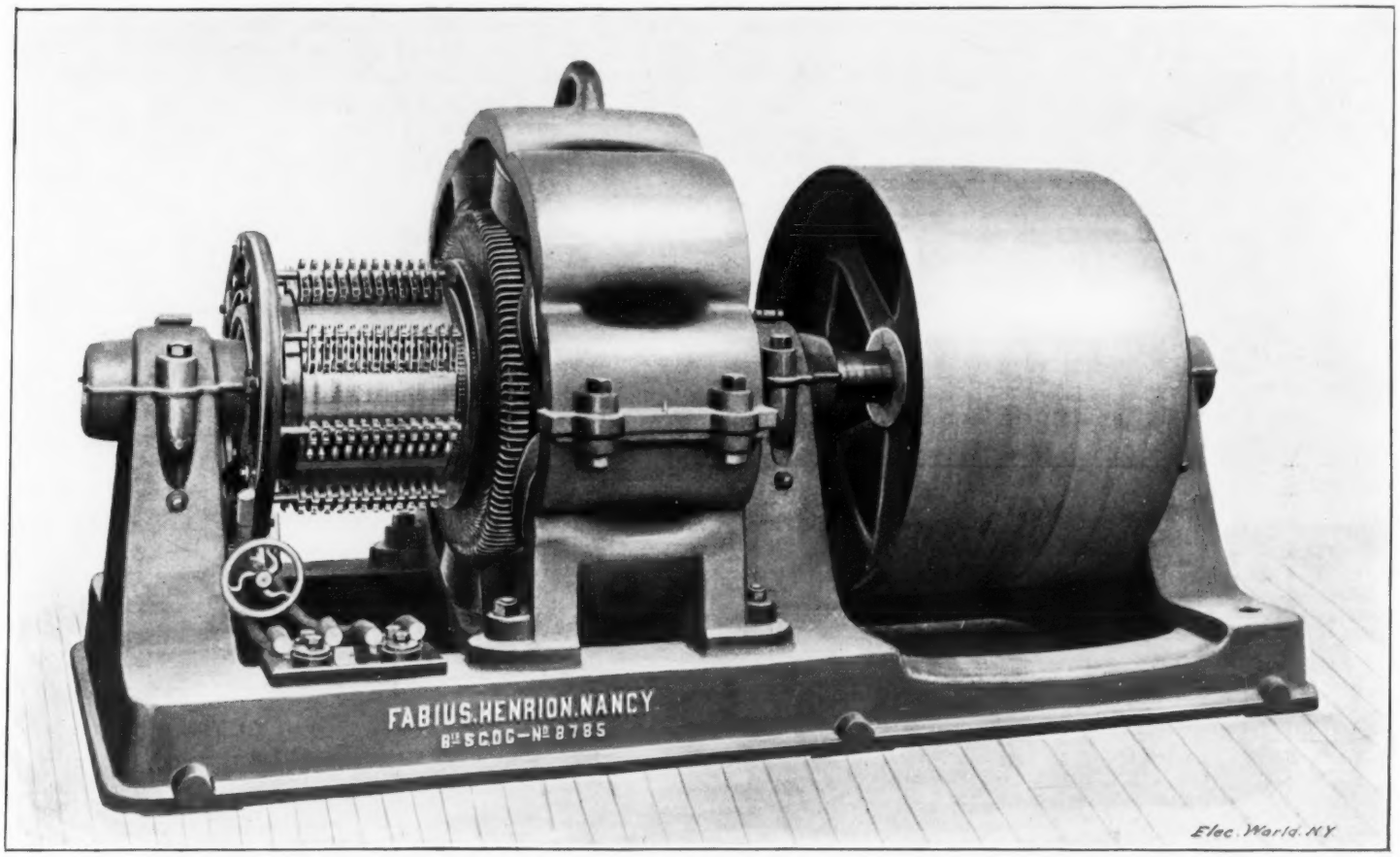


FIG. 6.—300-HP MULTIPOLAR GENERATOR.

ALTERNATING-CURRENT MACHINES.

Of alternating-current generators and synchronous motors only the inductor type is made by Fabius Henrion.

These machines, as shown in detail in Fig. 9, differ radically from the types known on this side of the water, such as the Stanley machine, for example, in that the fixed armature windings run right through from end to end of the machine, the same coils thus receiving the magnetic flux from both rings of poles. To make such a machine give alternating currents, the poles of one ring are offset or staggered radially between those of the other ring; thus the flux linked with any one armature coil alternates with the movement of the rotor from a maximum in one direction to a maximum in the

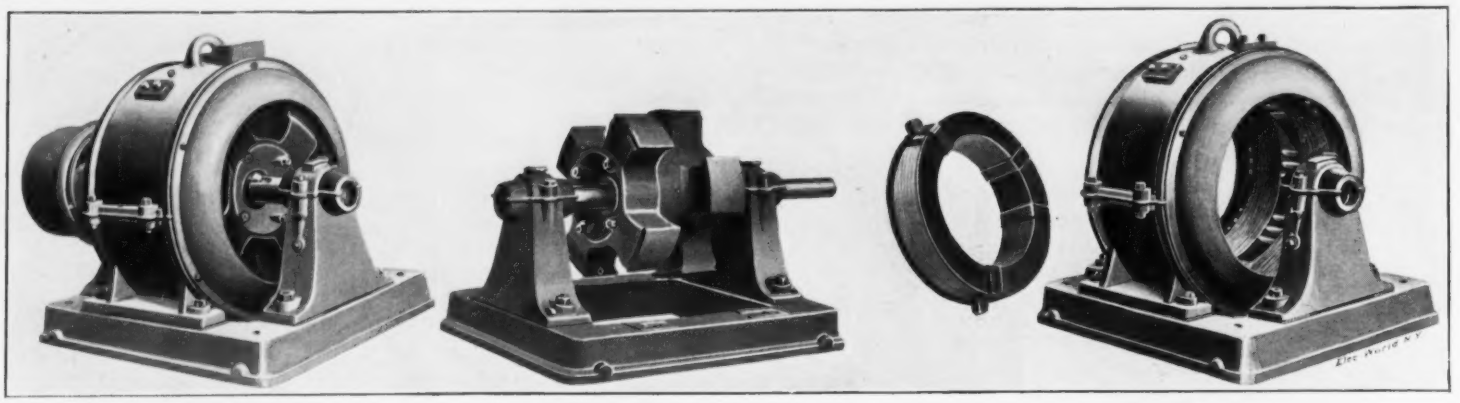


Fig. 9.—Assembled and Detail Views of Inductor Generator.

other, instead of from zero to a maximum as in American designs. The flux entering any part of the armature iron, however, does not change its sign, since the positive lines come from the poles of the one ring and the negative lines from those of the other.

In this way the double system of end connections in the middle of machines of the American type, a position difficult to reach for inspection and repairs, is replaced by straight exposed runs of the armature windings from one of the two rings of laminations to the other, the laminated iron not being continued across this space. In the French machine the conductors are tunnel wound in insulating tubes, which are continued right across this space. On account of these straight runs the field exciting coil cannot be placed in this position as in American types, but must have an external diameter less than the internal diameter of the fixed armature, and must fit down between the outwardly projecting poles of the rotor, which in turn must be divisible into two parts to allow the removal of the exciting coil. No such machine is on the American market, although a similar machine, known as the Fynn dynamo*, is manufactured in England. The rotating part, which is of cast steel, has no laminations at its polar extremities, but the latter are oddly cast with overhanging lips or horns on their inner edges and corresponding bevels at their outer edges, as though yielding to the inward pull of the lines of force. The machine shown has eight poles and a single-phase winding distributed in three closed tunnels over about one-half the pole angle. The end connections are protected by circular covers bolted to the yoke, the latter being divided in a horizontal plane, so that the upper half can be removed. The exciter is generally coupled to one end of the shaft, but the machine shown in the illustration has a flange on the main driving pulley separating off its inner end to carry a narrow belt for driving the exciter.

The same machine is put out as a synchronous motor, but for the majority of alternating-current motor work an induction machine is made. This is of the internal, rotating-secondary type with short-circuited or "squirrel-cage" rotors in all sizes up to 1½ horse-power, wound secondaries with collector rings in all sizes above 20 horse-power, and either arrangement in the intermediate sizes. One of the smaller sizes is shown in Fig. 10, its chief peculiarity to American eyes being the helical course of the secondary slots or bars, the purpose of which is not evident, especially as the primary slots are axial. The machine shown is four-polar, wound for three-phase currents, with two slots per pole per phase. The method of distributing the winding is clearly shown in the view with the end plate and rotor removed. The primary slots are open to the air gap, but not parallel sided, the opening being narrower than the maximum width of the slot, which is lined with a sleeve of insulating tubing projecting beyond the end of the slot and split down the opening, so that the wires can be laid in the slot instead of being drawn through. The method of grouping the end connections from the two slots per phase into one coil and binding them together with cord or rope is clearly shown in the illustration. The round tunnels of the rotor have a similar opening or slot narrower than the tunnel proper to reduce the self-induction.

The air gap is, of course, reduced to the lowest possible limit in order to get a low magnetizing current and good starting torque. To accomplish this both the interior surface of the stationary primary and the exterior surface of the rotating secondary are ground true after the laminations are assembled under hydraulic pressure, and a stout steel shaft is used running in journals of a composition specially prepared to give minimum wear. The motors are wound for the standard frequency of France, namely, 50 cycles per second, and the performance of one such three-phase motor rated at 5 horse-power is given in the accompanying diagram, Fig. 11. The weights, speeds and outputs of some of these motors may be of interest to compare with American figures. A 20-hp machine, for example, runs at 750 r. p. m. light and 720 loaded, and gives an efficiency at full load of about 88 per cent., with a power factor of 0.8. The weight of this machine is 850 kilograms (about 1900 pounds), and its listed price, with wound secondary and a primary winding suitable for 110 and 220 volts, is 3700 francs, about $750.

These motors will all start under full load torque with the secondaries short-circuited; in fact, their superiority in one respect to direct-current motors is exhibited by the claim that any of them will stand, when running at full speed and under full load, an instantaneous reversal of the direction of the rotation of the field

*See The Electrical World, December 18, 1897, page 729.

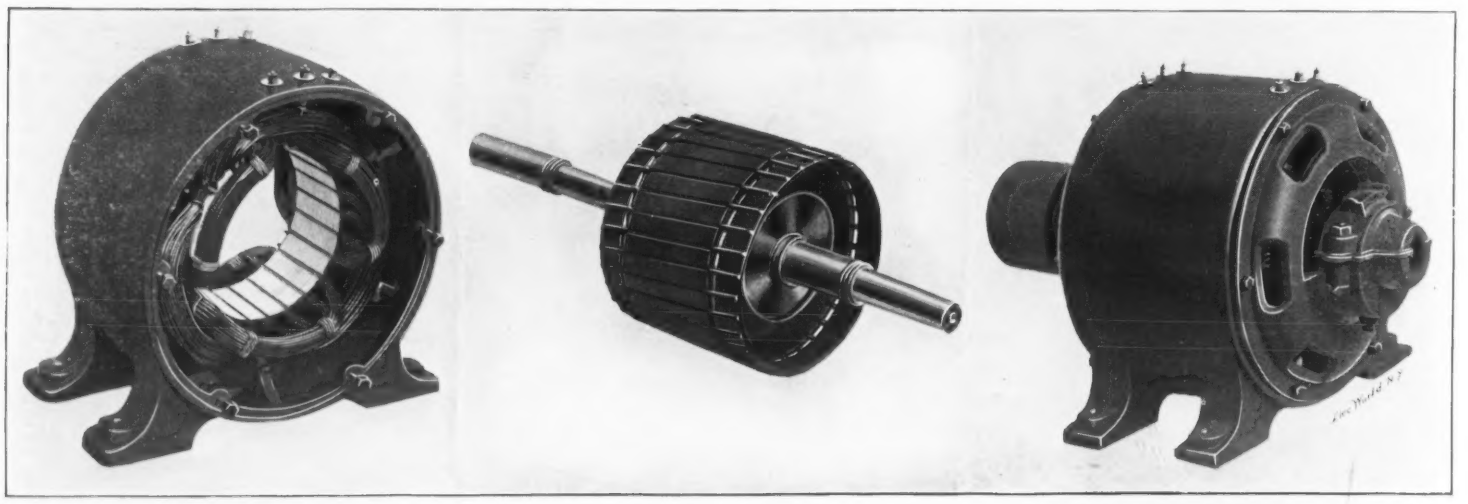


Fig. 10.—Views Showing Constructive Details of Three-Phase Alternating-Current Motor.

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without the interposition of any resistances. It is recommended, however, that the load be thrown off for starting by means of a loose pulley or clutch. A starting device commonly used with the wound secondaries is a three-part rheostat of a type quite generally employed with the apparatus of this make, although considered unscientific and unsatisfactory in this country. It is, in short, a water rheostat and, as shown in Fig. 12, is made up of three corrugated sector-shaped plates which may be lowered into the liquid or raised from it by rotating them about a common axis by means of a handle. The motors are also used with single-phase supply, the starting being effected with a phase-splitting device, consisting of a non-inductive resistance condenser.

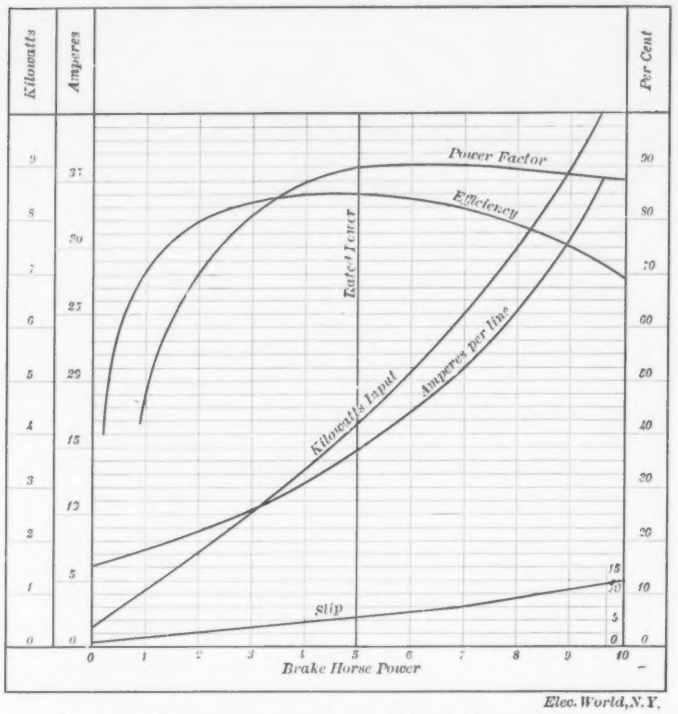


FIG. 11.—PERFORMANCE OF 5-HP THREE-PHASE MOTOR.

CONTROLLING APPARATUS.

In the way of rheostats, switches, motor controllers, etc., the designs bear no apparent resemblance to those of the Yankees. A field rheostat is shown in Fig. 13, the resistance being in the form of vertical wire helices wound free of any supporting rods and in a single plane. An automatic motor speed regulator is shown in Fig. 14, the centrifugal governor operating an inclined rod carrying a number of branches like the teeth of a comb, which, as the rod is dropped by the governor, successively enter mercury contacts, varying the resistance in the circuit. Another form of water rheostat for direct-current work is shown in Fig. 15, this being in fact an automatic low-voltage release motor controller. A heavy counterweight raises the grid from the liquid, the water rheostat being

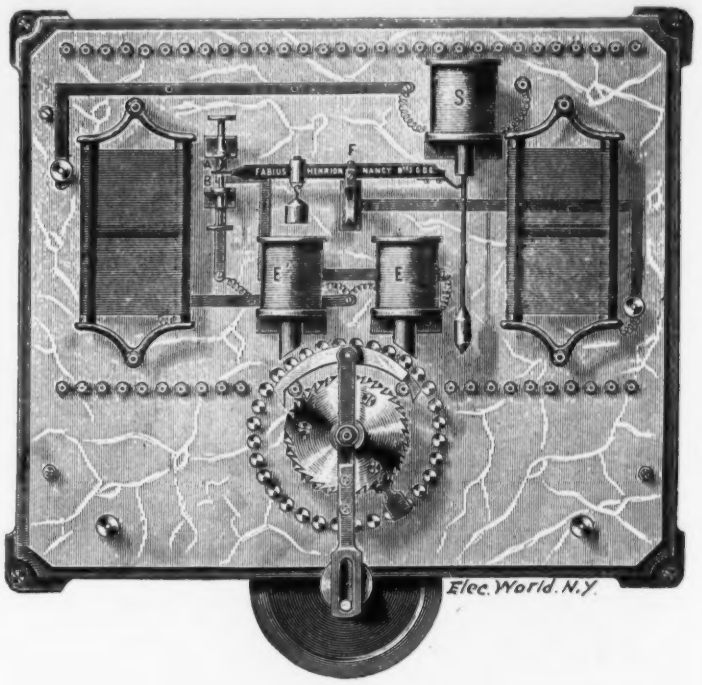


FIG. 16.

FIG. 12.

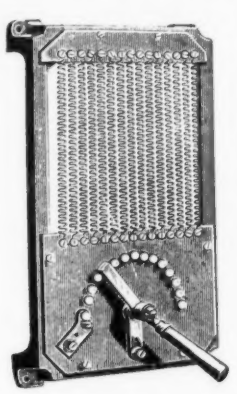


FIG. 13.

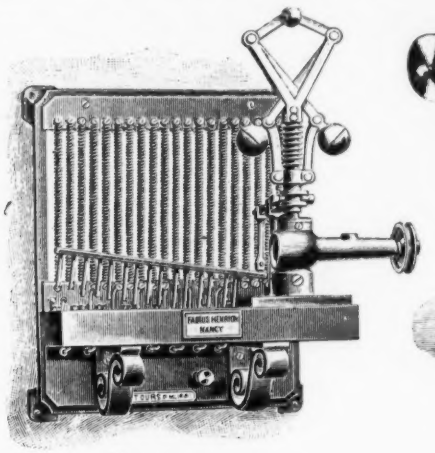


FIG. 14.

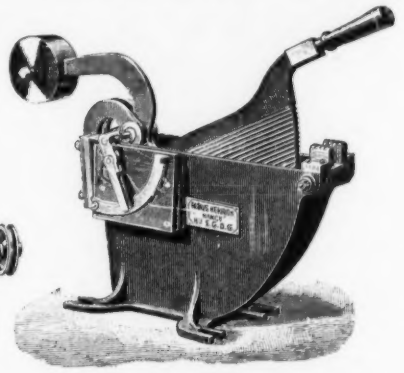


FIG. 15.

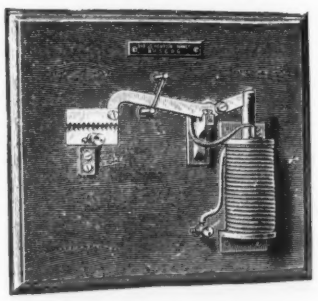


FIG. 17.

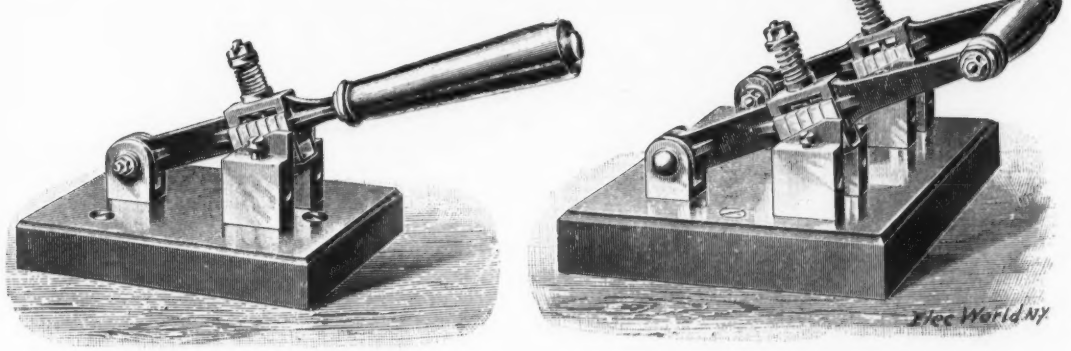


FIG. 18.

short-circuited when the grid is down by clips which grasp a copper blade close to the handle.

An automatic voltage regulator of the relay and ratchet and magnetized pawl type is shown in Fig. 16, this being used either with constant-potential or constant-current machines, in the former case varying the resistance of the field rheostat and in the latter case being mounted on the machine and varying the lead of the main brushes themselves. A magnet S operates contacts A or B, which respectively excite the coils E or E', which in turn respectively attract the ends of the anchor escapement; this, being kept always in operation by the small crank and slotted crosshead shown below rotates the ratchet wheel in one direction or the other according to which magnet is energized. The ratchet wheel carries a contact sweeping over the studs of the rheostat sections.

Fig. 17 shows a lightning arrester with a magnetic device for increasing the air gap after the passage of the discharge.

In the line of switches, Fig. 18 shows a single-pole and a double-pole quick-break type with helical springs around bolts on the blades which pull the contacts up promptly when the pressure becomes sufficient to overcome the friction. The current does not pass through the hinge, but enters the switch blade through a heavy clip on one side and leaves through another clip on the other side but a short distance from it. The contacts are laminated.

In the way of fusible cut-outs, Fig. 19 shows a form arranged for a multiplicity of small wires rather than one large wire or strap, the terminals being grooved to give these wires good contact without end clips. French circuit breakers are a little primitive as yet, and Fig. 20 shows one with mercury contacts and a magnet arranged to open the instrument with 60 amperes. A device—resembling in appearance a flush switch and in operation a low-voltage release—for turning off lights from the central station or the engine room of an isolated plant is illustrated in Fig. 21, this being a switch magnetically maintained in its closed position. It is intended for use in hotel bedrooms and such places where people are careless and leave the lights turned on when not needed. A momentary interruption at the switchboard and these switches all open, those persons needing light being expected to restore their switches to the closed position.

MEASURING INSTRUMENTS.

A complete line of measuring instruments is also put on the market by this house, those for direct current having the general appearance shown in Fig. 22. They are of the round type without permanent magnets or springs, the actuating mechanism consisting simply of a solenoid and a soft iron armature, the restoring force being gravity and the instruments, therefore, being non-polarized. A multiplier for use with voltmeters is shown in Fig. 23, with several positions of an adjustable handle whereby different multiplications can be obtained. Fig. 24 shows a type of instrument dependent on heating effects and useful, therefore, for alternating as well as direct currents, an alloy of silver and platinum being used. Fig. 25 shows an instrument designed more nearly on American lines, its principle being that of the D'Arsonval galvanometer with a spring restoring force, in order to allow its use in any position.

STORAGE BATTERIES.

Accumulators with plates electrically formed by the Planté process are also made by the same house, which has established at Pagny-sur-Moselle a hydraulic power station for the generation of the current needed in this tedious process of plate formation. Each plate, as shown in Fig. 26, is made up of a core with saw-tooth-shaped projections on either side at such a distance that even when formed there is considerable irregularity and consequent increased area of the surface. The core is made quite thick to give rigidity to the plates, which in turn are made in small sizes to reduce the tendency to buckling. For a 1000-hour battery at a ten-hour discharge rate, the average voltage per cell at this rate of discharge is 1.85 volts, the number of positive plates being 29, and the weight of the load being about 300 pounds per cell.

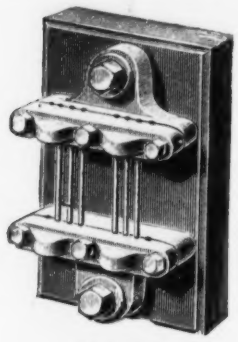


Fig. 19.

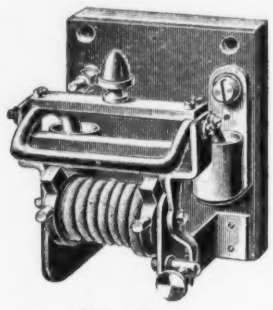


Fig. 20.

Fig. 21.

Fig. 22.

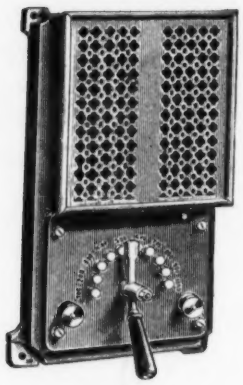


Fig. 23.

Fig. 24.

Fig. 25.

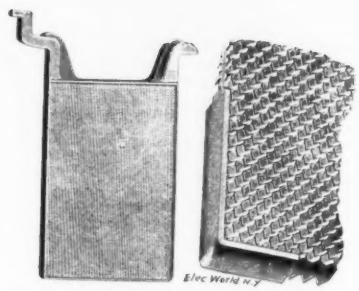


Fig. 26.

INCANDESCENT AND ARC LAMPS.

The incandescent lamps of Fabius Henrion have the name of the maker etched in the glass of each, with the figures of the voltage and the candle power. They are made with either of two efficiencies, 3 or 2½ watts, and the latter are listed in voltages up to 250 volts and candle powers as low as ten. Two filaments in series are used in the high voltage lamps, with a single loop in the end of each filament, and no anchors. A complete line of Pilsen open arc lamps is made up for both direct and alternating current work, the direct-current regulator being of the differential type, and the alternating-current a small disc induction motor with a series magnet and a shunt magnet tending to drive the disc in opposite directions, no escapement, clutch or other mechanism being necessary. The carbons for these arc lamps are a specialty of this house, the high-grade carbon having given recently quite a remarkable run of voltage in a test made at the Central Laboratory of Electricity of the International Society. The potential difference across the arc varied no more than one volt in an hour's run. For the enclosed arc a special line of carbons has been brought out.

Alternating-Current Machinery.

BY EDWIN J. HOUSTON AND A. E. KENNELLY.

CHAPTER XXV.*

SINGLE-PHASE ALTERNATORS.

In continuous-current dynamos, having commutators of a fairly large number of segments, the magnitude of the e. m. f. does not vary with the shape, area or disposition of the pole-pieces relatively to the armature, provided that the same useful total magnetic flux enters the armature from each pole, and that the conductors are distributed over the surface of the armature with reasonable uniformity, so as to avoid marked pulsations of e. m. f. at the passage of the brushes from one commutator segment to another. Thus, if a continuous-current generator gives 500 volts at open circuit across its terminals, at a given speed of rotation and a given total useful magnetic flux passing through the armature from each pole, then it will continue to give 500 volts, approximately, under all conditions of variation in the shape of area of the pole-pieces so long as the total useful armature flux remains the same. The shape of the pole-pieces does not, therefore, enter into the question of e. m. f., except in regard to the subsidiary question of magnetic leakage, excitation, waste of energy in field coils, armature reaction, etc.

In the case of alternating-current dynamos, however, the magnitude of the e. m. f. generated depends not only upon the speed of rotation, number of armature conductors and useful magnetic flux passed through the armature from each pole, but also upon the distribution of the magnetic flux relatively to the armature conductors; i. e., upon the shape of the wave of the e. m. f., so that if we alter the grouping of the conductors on the surface of the armature, or the disposition of the magnetic flux through which they pass, we alter the wave of e. m. f. which is generated, and so alter within certain limits the magnitude of the e. m. f. Consequently an alternator which might give by voltmeter across its terminals on open circuit an e. m. f. of, say, 2000 volts effective, when the pole-pieces and armature conductors were arranged so as to give the greatest amplitude of sinusoidal wave, might give, say, from 1700 to 2300 volts when the pole-pieces and armature conductors were arranged so as to give a distorted wave of e. m. f.

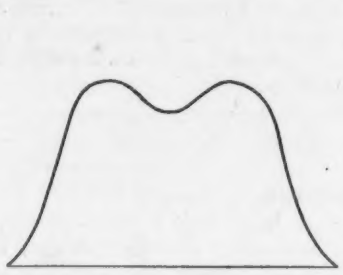
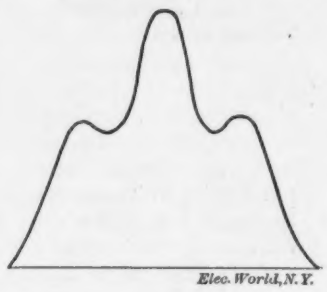


FIG. 144.—FLAT WAVE.



Elec. World, N. Y.

FIG 145.—PEAKED WAVE.

The designer of a continuous-current dynamo has therefore to shape its field poles with a view to securing sparkless commutation, reasonably low excitation loss and other conditions of good operation; while the designer of an alternating-current dynamo has to consider the shape of its poles and their disposition relatively to the armature conductors, in order to secure the highest available e. m. f. and best shape of the e. m. f. wave for the system to be operated.

If an alternator is designed to produce a sinusoidal wave of e. m. f., has p pairs of poles, and has to supply a frequency of n periods per second, its armature must make $r = \frac{n}{p}$ revolutions per second. Then the e. m. f. generated by the machine will be, on the basis of a sinusoidal wave,

$$E = \frac{\pi \sqrt{2}\, p\, r\, N\, \Phi}{100{,}000{,}000} \text{ volts effective, where}$$

N is the total number of loops connected in series on the armature, and Φ is the total useful magnetic flux in webers passing through the armature from each magnetic pole. Substituting the frequency n for $p\,r$ the formula becomes

$$E = \frac{\pi \sqrt{2}\, n\, N\, \Phi}{100{,}000{,}000} \text{ volts effective (sinusoidal wave), and if we substitute the angular velocity } \omega = 2\,\pi\, n$$

$$E = \frac{\omega\, N\, \Phi}{141{,}400{,}000} \text{ volts effective (sinusoidal wave). The maximum e. m. f. at the peaks of the sinusoidal waves will be } E_{max} = \frac{\omega\, N\, \Phi}{100{,}000{,}000} \text{ volts. Thus, if an alternator supplies}$$

500,000 webers usefully through each pole into the armature and has 1000 turns in series, and gives a frequency of 60 cycles ($\omega = 6.2832 \times 60 = 377$) then its effective e. m. f. on open circuit, on the basis of a sinusoidal wave, will be

$$E = \frac{377 \times 1000 \times 500{,}000}{141{,}000{,}000} = 1333 \text{ volts effective.}$$

The actual e. m. f. might, however, be less than 1000 or more than 1500 volts, if the wave of e. m. f. were not sinusoidal.

If an alternating wave of e. m. f. be considered as consisting of a fundamental sinusoidal wave with superposed harmonics, then the effective e. m. f. will be the same whatever may be the phase of any or all of the harmonics with respect to the fundamental or to each other. The relative phase of the harmonics will, however, affect the shape of the wave of e. m. f., and thus have a decided influence upon the energy wasted in the iron cores of transformers or other apparatus connected with the circuit, a peaked wave of e. m. f. usually tending to reduce the loss, and a flat wave to increase it.

Whatever may be the shape of the wave of e. m. f. at no load, the effect of armature reaction under load is to bring about a distortion of the magnetic flux through the machine, so that the wave of e. m. f. becomes distorted to a greater or less extent as the load is applied.

The wave form of e. m. f. delivered by an alternator is usually approximately sinusoidal with armatures having a distributed winding or multi-tooth construction. On the other hand it is usually far from being sinusoidal in pole-wound armatures of the uni-tooth construction. Figs. 144 and 145 are general types of waves which may be obtained from such armatures, the former being a flat-topped and the latter a peaked wave. It may be considered that in each case the distorted wave is equivalent to a fundamental sinusoidal wave, with an addition of harmonics superposed upon it. It is not, however, necessary in dealing with the circuits supplied by such alternators to analyze the e. m. f. into harmonic components. For nearly all practical purposes the e. m. f. may be treated as if it were a sinusoidal e. m. f. of equal effective value. The principal difference is, that whereas the impedance in the circuit of an alternator producing a sinusoidal e. m. f. is $j\,x = j\,l\,\omega$, that is to say, a real reactance equal to the product of the self-inductance of the circuit and the angular velocity, the apparent reactance $j\,x$ in the circuit of an alternator producing a complex e. m. f. is an apparent reactance which is usually different from the product $j\,l\,\omega$. The apparent impedance of an alternator circuit is, therefore, not necessarily the same as the impedance which the circuit would show to a sinusoidal e. m. f., or which might be computed from its resistance and self-inductance. The apparent impedance is, however, the quantity which is actually observed, and it is the equivalent in the real circuit of what the real impedance would be in a simple sinusoidal circuit with no iron cores in its apparatus.

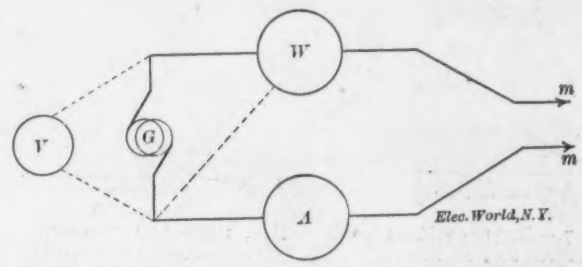


FIG. 146.—MEASUREMENT OF IMPEDANCE IN A CIRCUIT OPERATED BY A GENERATOR SUPPLYING A COMPLEX WAVE OF E. M. F.

In Fig. 146 G represents an alternating-current generator supplying a pair of mains $m\ m$ through an ammeter A and a wattmeter W. The voltmeter V also measures the effective pressure at terminals. Then if E be the e. m. f. indicated by the voltmeter and I the current strength indicated by the ammeter, the apparent impedance of the external circuit is $Z = \frac{E}{I}$ ohms. This, however, only determines the numerical value of the impedance and not its angle. If the circuit were reactanceless, so that the pressure and

*Continued from THE ELECTRICAL WORLD, February 5, 1898.

current were in phase, the power P, indicated by the wattmeter, would be

$$P = E\,I \text{ watts,}$$

but owing to the existence of reactance in the circuit, P is almost invariably less than $E\,I$. The power factor of the external circuit is, therefore, the ratio $\frac{P}{E\,I}$, and the angle of the impedance is the angle α whose cosine is equal to the power factor, or $\alpha \quad cos^{-1}\frac{P}{E\,I}$. For example, if the pressure at the terminals of the alternator be $E =$ 1100 volts, the current $I = 22$ amperes, the impedance $Z = \frac{1100}{22}$ $= 50$ ohms. If the wattmeter shows $P = 20{,}000$ watts, then the angle is $\alpha = \cos^{-1}\left(\frac{20{,}000}{24\,200}\right) = \cos^{-1} 0.8265$, since the apparent power is $1100 \times 22 = 24{,}200$, and by reference to a table of cosines this angle is $\alpha = 34^\circ\ 15'$, Fig. 147. The apparent impedance is therefore either $Z = 50\angle 34^\circ\ 15'$, or $50\diagdown 34^\circ\ 15'$, and the measurement does not directly determine whether the angle is positive or negative, since it does not show whether the current leads, or lags behind, the e. m. f. In practice, however, if there are no condensers or equivalent apparatus in the circuit, the current will lag behind the pressure, owing to the influence of inductance, so that the apparent impedance of the circuit is $50\angle 34^\circ\ 15'$ ohms. Of this impedance the apparent resistance is $Z \cos \alpha$, or $50 \cos (34^\circ\ 15') = 50 \times 0.8265 = 41.325$ ohms, and the apparent reactance is $50 \sin (34^\circ\ 15') = 50 \times 0.5628 = 28.14$ ohms, so that the apparent impedance is $(41.325 + j\,28.14)$, and the circuit behaves as though the alternator gave a simple sinusoidal e. m. f. to a circuit of 41.325 ohms actual resistance, and 28.14 ohms actual resistance.

When a separately excited continuous-current generator running at constant speed is loaded, the e. m. f. at its terminals diminishes, partly owing to the drop of pressure in its armature resistance, and

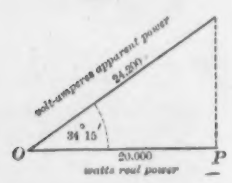


Fig. 147.—Ratio of Real to Apparent Power.

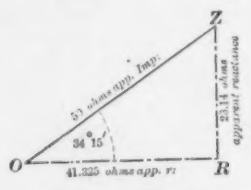


Fig. 148.—Analysis of Apparent Impedance into Apparent Resistance and Apparent Reactance.

partly owing to the influence of armature reaction. In the case of a separately excited alternator the terminal e. m. f. diminishes, not only owing to armature reaction and drop of pressure in its resistance, but also owing to the drop of pressure in its reactance, and all three influences have to be taken into account.

The resistance of an alternating-current armature is limited by the heating and energy loss permissible in the machine, and the drop of pressure in resistance may vary from 10 per cent. of the terminal pressure in a small alternator to 1 per cent. in a very large alternator in approximately the same ratio as in the case of a continuous-current generator.

The reactance of an alternator armature depends upon its self-inductance and the frequency of alternation. The reactance is in practice always greater than the resistance. The drop of pressure in reactance is, therefore, usually considerably greater than that in the resistance.

The reactance of an armature may in many cases be estimated by computation. Considering the magnetic circuit of the coils on the armature and the amount of magnetic flux linked with unit current passing through these coils, under their own m. m. f., the reactance of the magnetic circuit of these coils or of the armature taking them collectively, usually depends not only upon the form and dimensions of the armature, but also upon the position of the armature coils relatively to the field poles, so that the self-inductance is not a strictly constant quantity, but fluctuates during each alternation, an average value only being apparent in the circuit. A rough measurement of this quantity can be obtained by leaving the field unexcited and measuring the impedance of the armature when running at normal speed.

The armature reaction depends not only upon the degree of excitation of the field coils and on the current passing through the armature, but also upon the phase of the armature current. When the current in the armature is exactly in phase with the e. m. f. generated therein, the reactive effect of the armature windings upon the magnetic circuit is practically negligible. When, however, the current in the armature of a generator leads the e. m. f. the armature windings aid the field windings to an extent depending upon the angle of lead, and thereby increase the generated e. m. f. On the contrary, when the armature current lags behind the e. m. f., the m. m. f. of the armature windings opposes to a greater or less extent the m. m. f. of the field windings, and thereby diminishes the magnetic flux in the circuit and the generated e. m. f. The armature reaction is, therefore, not only dependent upon the amount of load, but also upon the nature of the load; i. e., upon the angle of displacement between the e. m. f. generated in the armature and the current flowing through the circuit.

(To be Continued.)

Employers' Liability for Hazardous Electric Appliances.

BY R. D. FISHER.

The rapid advance of electricity within very recent years as a factor in commercial and economic affairs has given rise to a considerable body of statute law, and to numerous judicial decisions involving in some respects the creation of new legal rules, which concern chiefly the application of well-established principles to new conditions of fact and circumstances. A most valuable feature of legislation is the bulk of statute law enacted for the purpose of fixing the rights and liabilities of electric corporations of various kinds. The body of the law relating to the duties of companies as carriers of messages and of passengers, and their liability for negligence, has been many years accumulating, and has become to a great extent settled; but a different problem is presented with reference to extra hazardous appliances furnished to the employee which involve the liability of the employer to an injured servant in consequence thereof. The apprehension which a prospective loss of employment engenders often amounts to a coercive influence, and this being so, courts are at a loss to know how much allowance ought properly to be made for the action of that influence on the mind of the servant.

If it is assumed that the fear of losing remunerative work does not deprive of its voluntary quality the action of a servant who continues in his employment with a knowledge of the existence of conditions which make the risk of injury greater than that which persons engaged in the same class of work are ordinarily called upon to incur, the conclusion is inevitable that an employer is entitled to carry on his business with even the most defective and dangerous instrumentalities, provided the servant, either by his own observation or as a result of instruction and warning, has attained full comprehension of the hazard to which he is exposed by the use of these instrumentalities. This conclusion the courts have not been at all backward in drawing. The judgment that the master was not liable has induced legislatures to enact truck acts, factory acts and employers' liability laws. According to English law the master may be guilty of the most cynically reckless neglect of duty regarding the hazards of machinery, and yet not be liable. Lord Bramwell, in the case of Dynen v. Leach, 26 L. J., Exch. 221, said: "There is nothing legally wrongful in the use by an employer of appliances or machinery more or less dangerous to his workmen, or less safe than others which might be adopted. It may be inhuman so to carry on his plant as to expose his workmen to peril of their lives, but it does not create a right of action for an injury which it may occasion when the workman has known all the facts, and is as well acquainted as the master with the nature of the machinery and voluntarily uses it."

The following passage from a Connecticut case will suffice to show how closely the American judges have echoed the sentiment of their English brethren:

"Every manufacturer has a right to choose the machinery to be used in his business in the manner most agreeable to himself, provided he does not thereby violate the law of the land. He may select his appliances and run his plant with old or new machinery, just as he may ride in an old or new carriage, or occupy an old or new house, as he pleases. The employee having knowledge of the circumstances and entering his service for the stipulated reward cannot complain of the peculiar tastes and habits of his employer, nor sue him for damages sustained in and resulting from that peculiar service." (29 Conn., 548.)

Compare the language used by the Massachusetts Supreme Court to the effect that it is the legal right of every person to carry on a business which is dangerous, either in itself, or in his manner of conducting it, if it is not unlawful and interferes with no rights of other persons. (102 Mass., 572.)

So the Michigan Supreme Court construed the doctrine of assumption of risks very strongly in favor of the employer, saying: "Obvious imperfections in methods or machinery, existing at the time of the employment, cannot be made the basis of a liability in favor of an employee who suffers an injury in the cause of his employment, since the employer has the right to have and use imperfect methods and tools, and to ask others to enter his employ to aid him in such use, and in so doing does not undertake to insure the employee." (97 Mich., 265.)

The general rules governing the operation of electric plants so far as concerns the employees are the same as those governing the relations of master and servant in relation to other electric plants, viz., that an employee is supposed to accept the obvious risks of the employment, and cannot recover for accidents caused thereby. To show how low the standard of duty is fixed the Wisconsin Supreme Court (87 Wis., 387) held that where a motorman was obliged, after removing a trap-door in a car, to put his arm near the revolving axle and gearing in an attempt to clean the commutator, his coat sleeve being caught and his arm drawn into the gearing and mangled while so doing, he having been instructed for eight days in the duty of a motorman and having been employed three days before the accident happened, having also seen other motormen clean the commutator, the schooling given him was sufficient, and that it was an obvious risk of the employment for which no recovery could be had.

Electric cars sometimes, owing to defective machinery, act stubbornly. This trick is called by the motormen "bucking," and may produce serious results. In Minneapolis a car so bucking threw the motorman over the dashboard, and then starting again ran over and killed him. The motorman had been employed a year. He notified the company of the defective machinery, and repeated attempts were made to remedy it. The court held the company liable in this case because it had notice of the habits of the car and had failed to remedy it in that it failed to replace a defective field coil in the rear motor, and it was negligence in the repairer not to remedy this defect, knowing of the bucking habit of the car. (54 Minn., 504.)

If the degree of care which the servant must exercise in order to escape injury is greater than that which, considering the exigencies of the work and other matters which are likely to divert his attention and produce a temporary forgetfulness of a known danger, it is reasonable to demand from men of average prudence and powers is reasonable to demand from men of average prudence and powers ought to bear the responsibility of any accident which may occur, quite irrespective of the question whether the servant was or was not aware of the nature and extent of the danger. The acceptance of this principle would involve an implied agreement of the servant to use ordinary diligence in the discharge of his functions, and make it a breach of duty in the master to keep his instrumentalities in such a condition that ordinary diligence will not always save the servant from injury. It would simply make his liability dependent upon whether he had or had not acted unreasonably, and therefore negligently, in holding out inducements to do work which could not be performed safely without the exercise of a degree of care which no fair-minded, considerate person would demand from a servant. This would prevent the cruel abuse of the doctrine of assumption of risks which has done so much to embitter the feelings with which capitalists or operators are regarded by the working classes of the country.

An Automatic Clutch for Motors with Low Starting Torques.

An ingenious automatic releasing clutch is used with single-phase induction motors made by the Elektricitats-Actien Gesellschaft, and described in London "Engineering." The clutch contains a liquid which, as the speed rises by centrifugal action, bulges out a flexible diaphragm, bringing the clutch surfaces into contact, the pressure of which becomes greater and greater with increased speed. In this way synchronous alternating-current motors and single-phase induction motors can be automatically relieved of their load on starting and automatically coupled to it when the speed rises to a proper point.

A Gift in Memory of Dr. John Hopkinson.

In his opening lecture to the engineering students at Cambridge University on October 14, Professor Ewing stated that a gift of £5000 had just been made by Mrs. Hopkinson in memory of Dr. John Hopkinson, the sum to be expended in an addition to the engineering laboratory. Professor Ewing said also: "I feel impelled to add a few words as to the loss which our profession—the profession on which you look forward to entering—has met with in the untimely death of Dr. Hopkinson. If I were to select any name to put before you as that of an engineer whose work and methods you would do well to follow, it would be his. He was a peculiarly conspicuous example of that union of scientific knowledge and genius with practical sagacity which goes to make a great engineer. His work was brilliantly original. In more than one department he led the way where a great host is now following; and his work was as sound as it was brilliant. His opinion was constantly being sought, partly because it was always fair and unbiased—his character was too fine for anything mean or unworthy to find a place—and partly because his judgment came near to being infallible. You know that he took in Cambridge the most distinguished place that any student can take. He at once plunged into engineering work, and from that time to the end his professional life was an unbroken series of successes. But he made time for much original work of lasting value in science, and the world of pure physics is deploring his loss as much as it is deplored by engineers. Such a man may, I think, be said to live on, not only in the results of his work, but in the force of his example. Dr. Hopkinson took from the first a warm interest in this laboratory and in the establishment of an Engineering Tripos at Cambridge. It was only a few days before his death that he spoke to me of his intention to promote a subscription for the much-needed extension of the laboratory. It is a peculiar pleasure to me to think that this laboratory will, through the noble gift of Mrs. Hopkinson and of his son and daughter, be henceforth associated with his memory and name."

Electrical Advances in Japan.

The second electric railway undertaking in Japan is the Hoshu electric railway, which will run from Beppu to Oita, in Kyushu. Work was suspended for a while owing to financial difficulties, but these have now been overcome and the construction is steadily advancing. The contract for all materials was let to the Saiga Electric Company, of Kyoto, which company in turn ordered the following pieces of main apparatus: Two Lancashire-type boilers of 160 horse-power each (made in Japan); one 160-hp McIntosh & Seymour high-speed engine; one six-pole, 110-kw General Electric railway generator; ten No. 21 Brill trucks and twenty 25-hp railway motors. The rails, generator and motors have arrived, and the work of installing them has begun. The engineers in charge of the work are Mr. H. Maki and T. Saiga, president of the Saiga Electric Company.

A striking example of modern industrial processes surrounded by the quaint beauties of old Japan is the case of the tobacco factory of the Murai Brothers Company, in the ancient capital of Japan, Kyoto. In this factory the electric distribution of power is used, the amount being 200 horse-power, and upon its tower has recently been placed a large searchlight. Our Japanese correspondent naïvely advises us that the present name for the searchlight in Japanese is tan-kai-to, which means the lamp which shines over the sea in the night, this form of apparatus having been first used in the navy, but hereafter, on account of its adoption on land, the name will probably be changed.

An Ingenious Electric Brake.

A combination of foucault currents and friction braking designed to give a more uniform retarding effort over a wider range of speed than either gives alone has recently been patented in England by the Helios Company. A group of stationary magnets attract a rotating armature, the releasing force being a light spring. At high speeds centrifugal weights properly attached to the armature prevent its being attracted by the magnets, but the action of the latter causes powerful foucault currents. As the speed comes down and these currents become weaker, the centrifugal force of the rotating weights is finally overcome by the magnetic attraction, the armature closes on the pole pieces and further retardation is obtained by mechanical friction.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE
AMERICAN AND FOREIGN
By Carl Hering.

Dynamos, Motors and Transformers.

MOTORS.—Lond. "Engineering," Oct. 28.—In this continuation of a descriptive article on the Schuckert Company (see "Digest" last week) a number of well-illustrated descriptions of several forms of their motors are given, including also some electric hoists.

CONTINUOUS-CURRENT DYNAMOS. Guilbert. "L'Eclairage Elec.," Oct. 22.—Brief, illustrated descriptions of various recent improvements, taken from patent specifications.

ALTERNATING CURRENTS OF ANY FREQUENCY.—"Elec. Rundschau," Oct. 15.—Brief, illustrated description of the Union generator, taken apparently from patent specifications. It is a continuous-current generator with movable brushes.

DYNAMOS.—Lond. "Elec.," Oct. 28.—Brief, illustrated descriptions of the Jackson dynamos, which are wound on the Sayers system. They are said to be sparkless at all loads without a change of position of the brushes, even with considerable overload. The illustrations show only the external views and the description is very brief.

BEST THICKNESS OF TRANSFORMER PLATES. Bledell, Klein and Thomson. "Science," Oct. 31.—A brief notice of an A. A. A. S. paper giving a curve of the relation between the thickness of the plate and the total loss due to hysteresis and eddy currents, from which it was found that the curve has a broad, flat minimum extending from about 10 to 15 thousandths of an inch in thickness.

ARMATURE WINDINGS. Rice. "Amer. Elec.," Nov.—A description of telescope windings, which are used on direct-current machines intended for very large currents at low voltages. There are several separate windings arranged side by side on the same armature, but not connected with each other; the brushes, which are very wide, connect the various circuits in parallel.

MULTI-CIRCUIT DYNAMO. Murphy and Van Saun. "Amer. Elec.," Nov.—A description, accompanied by a number of curves, of a test of a Rushmore multi-circuit direct-current dynamo, which will supply two or more independent currents at different voltages. The results are claimed to show that the machine is entirely commercial and can be used in many cases with great economy. The machine itself has already been described in THE ELECTRICAL WORLD.

Lights and Lighting.

NEW INCANDESCENT LIGHT.—"L'Elec.," Oct. 29.—A short note on what is called a discovery, which, it is claimed, will probably revolutionize electric lighting. It is being experimented with by the Ganz Company, of Budapest. The incandescent part consists of a tube of alumina of 0.3 mm in diameter, which is heated to incandescence in the open air, thus requiring no bulb and being cheap to construct. These tubes have been kept incandescent for more than 700 hours without any apparent change. The only difficulty is that the material will not conduct while cold, but this is overcome by a preliminary heating, during which time the lamp is lit by means of platinum wires. The results of experiments are said to be quite satisfactory.

ARC LAMPS. Richard. "L'Eclairage Elec.," Oct. 22.—Brief, illustrated descriptions of various improvements taken from patent specifications.

THEATRE LIGHTING.—Lond. "Elec. Rev.," Oct. 28.—A brief, illustrated description of the plant in a new theatre at Plymouth.

Power.

ELECTRIC MOTORS IN MACHINE SHOPS.—Lond. "Engineer," reprinted in the Lond. "Elec.," Oct. 28.—A long editorial discussing the question of the relative economy and advantages of the electric and the shaft and belt systems. It is thought that the electrical enthusiasts overdo the advocacy of electrical driving; what is really wanted is to know which is the more economical method of driving, electric motors or shafts and belts; it is claimed to be almost impossible to obtain trustworthy information on this important subject. A rough estimate is made of a new plant requiring 300 horse-power; it is claimed that there is only one question to be considered, and that is which is the cheapest method of distributing the power of the engine; (this is not the only question, however, as it has been repeatedly shown that there are many other advantages to be considered, and that they are sometimes of greater importance than the saving of a little power). It is claimed that the cost of the driving plant when electricity is used must be much greater than when shafts and belts are used; (but this does not necessarily follow when inefficient separate engines, sometimes with their own boilers, or with long steam pipes, are used). In conclusion, a recent proposition by Painton is briefly referred to; he proposes to construct a torpedo destroyer in which steam turbines are to be used to drive dynamos, which in turn drive motors attached to six screw shafts, each carrying three screws and making 2500 revolutions per minute; it is reported that Edwin S. Cramp has said of this that it is not only in every way feasible, but is a decided improvement on the Turbinia (in which the propellers are driven directly by steam turbines and therefore run too fast); he believes that there will be a decided economy in fuel and steam, that the use of a dynamo and motors to run the shafts is a decided gain, and that the greater distribution of the power over six propellers is a good feature.

THE MIDLAND RAILWAY LIGHT AND POWER PLANT.—Lond. "Engineering" and "Elec. Eng.," Oct. 28.—A reprint of the paper which was abstracted in the "Digest" Oct. 22, but including the illustrations, which were not contained in the reprint previously noticed. Among other things he stated that the efficiency of the ordinary belt and shaft transmission at the workshops of that railroad was as low as 28 per cent., and in many other places no higher than 20 per cent. There was considerable difference of opinion in the discussion as to the relative advantages of separate driving and group driving; Langdon advocates separate driving wherever more than 1 horse-power is needed; Harris and other speakers claim that the question of first cost often rendered it inadvisable to use separate motors for each machine, even when these are of considerable size.

COMBINED LIGHTING AND POWER PLANT FOR DOCKS. Aldridge. Lond. "Elec. Eng.," Oct. 28.—A reprint of a short Brit. Assn. paper describing briefly several plants and showing the advantages of combining the lighting and power plants instead of using electricity for lighting only and hydraulic power for the cranes. He considers the subject from the dock owner's point of view. At Copenhagen all the power and light is supplied from one plant; the load diagram is given; there is an accumulator in connection with the plant; the total capacity is 1250 horse-power, 900 of which is for motors. If they were separate plants at least two-thirds of the steam plant would have to be for lighting only, and this part would be idle for at least two-thirds of the day. At Rotterdam electric cranes are also used; a table gives the details of the working costs for 1896, and another one more briefly for 1897. At Southampton there is a hydraulic and an electric plant, but the boilers are common to both; a load diagram for a week is given. The plant at Cleveland, Ohio, is well spoken of, and it is said that the electrical machinery for handling goods is much more developed there than in England. In using electric power, extensions can be made at much less cost; an advantage over hydraulic power is that there is no danger from the freezing of water in winter. One of the reasons why electric power is used so little in England is that most docks and harbors are already equipped with the hydraulic system. It is thought that electric plants can be erected at a price which will compare favorably with the hydraulic system.

ELECTRICAL POWER FOR BRIDGE CONSTRUCTION.—Lond. "Elec. Eng.," Oct. 28.—A note on the use of electric power in the erection of a 900-foot span at Budapest, where only electric power is used. In driving the piles the electric ram drove forty per day, while a steam ram drove only thirty, and was therefore abandoned. An electric windlass and a number of electric pumps are used. The advantages of electric power during the six months' use in this plant have been established, so that in future only electric motors will be used for these purposes.

HIGH-TENSION PLANTS.—Lond. "Elec. Eng.," Oct. 28.—An answer to a request to compare the high-tension continuous system with the high-tension alternating one, in capital, cost, repairs, and maintenance. It is thought that the capital outlay is in favor of the alternating-current plant; this is also true, as a rule, for repairs and maintenance; greater experience with the continuous-current system, however, may change this.

SHOREDITCH DUST DESTRUCTOR. H. E. Kershaw. Lond. "Elec." and "Elec. Eng.," Oct. 28.—A brief reply to the criticism of Baker (see "Digest" last week). It appears that Baker had submitted a scheme for the dust destruction, which was rejected. (The present writer is chairman of the lighting committee.) Baker's estimate is based on a twelve months' expenditure and a nine months' income and includes the first quarter, which is invariably a heavy loss to any undertaking. In the course of a few weeks the official report will be made public; at present he can only say that the combined scheme has made a profit in the first year's working, after making all allowances, of $10,000 net. Besides this, they are paying back about $25,000 a year for interest and capital, which means that in thirty years the combined plant will be paid for, and that this therefore covers depreciation and maintenance charges. A letter by Robinson, the clerk of the vestry, is published in part in the "Elec." and in full in the "Elec. Eng."; he also points out the errors in Baker's estimate.

BLAST-FURNACE GAS.—Lond. "Engineering," Oct. 28.—A

note giving the results of tests made by Witz with a 200-hp gas engine operated by gas from blast furnaces. The tabulated results are given; the gas used per break hp-hour was 117.6 cubic feet; the average calorific value of the gas was 110.2 thermal units per cubic foot.

TRANSMISSION OF POWER. Siemens. "Engineer," Nov. 1.—An abstract of his paper, which was noticed in the "Digest" Oct. 15.

PRINTING ESTABLISHMENT. Damon. "Elec. Eng.," Nov. 10.—The beginning of a description of the electric equipment of the Conkey printing establishment in Indiana. See THE ELECTRICAL WORLD of Nov. 12 for a full description of this plant.

Traction.

POLYPHASE TRACTION.—Lond. "Elec.," Oct. 28.—An editorial discussing the relative merits of the usual continuous current, the combined polyphase-continuous current and the polyphase-current systems. In the interference with telephones and telegraphs the polyphase motor system is at a great disadvantage; in Lugano, where the latter system is used, the telephone system has been thrown into great confusion, while on the Jungfrau Railway the disturbance is still too great for the satisfactory transit of messages. In the electrolytic action of the leakage current the polyphase current is undoubtedly superior; if with the continuous current the insulated return is adopted the system would be better than the polyphase. The advantages from an engineering or economic point of view are discussed; the absence of a commutator is an advantage; the polyphase motor can be more compactly and economically constructed and is lighter for the same speed and output, besides requiring only stationary transformers, but the latter is not so great an advantage as it might at first seem, as the rotary transformer requires remarkably little attention, as shown in Dublin, for instance, where the sub-stations are in charge of boys; polyphase motors are not necessarily cheaper, as the magnets have to be laminated; in regulation the continuous-current motor has the advantage. Brown advocates regulation of polyphase motors in part by alternation of the stator circuits from the star to the mesh formation, and by cutting out a certain number of poles, thereby altering the speed of synchronism (as he is the designer of the Lugano, Gornergrat and Jungfrau railways it is probable that this system of regulation is adopted there). The power factor of polyphase motors is always less than unity, and the trolley wire would therefore have to carry more current. The conclusion is that on the whole the advantage lies with the continuous-current motor systems, and that the combined polyphase-continuous will in general be the most economical to adopt where the feeders are long or where there is an advantage in placing the power station at some distance.

THOMPSON-WALKER SYSTEM.—Lond. "Elec.," "Elec. Rev." and "Elec. Eng."—A brief account of an inspection of the experimental track at Willesden; the system itself was described in THE ELECTRICAL WORLD Oct. 22. The danger of leaving the plugs alive is so great that the Board of Trade would not sanction any system in which this is possible; it is claimed that in this system it is almost inconceivable that this should happen; the mechanism is less likely to get out of order. It is absolutely essential that a live piece of iron at 500 volts should be immediately over and in contact with the plug, in order to make it live; other systems depended upon the proximity of either a piece of iron or an electrical conductor. Among the effects to be guarded against is leakage from a feeder to a dead contact; in this system the contact knobs are so surrounded by permanently earthed metal casings that any leakage escapes to earth and cannot reach the knob; if any leakage should occur a fuse is blown. The mechanism in the box is completely enveloped in paraffin oil, thus preventing sticking; moreover, the circuit is broken between carbons before it is broken at the mercury surface. The car contains a small 500-volt accumulator to make the skate alive, should it pass over a dead plug and thus lose its current. To remove the mechanism below the plug was found to take only thirty-seven seconds, or to replace it, one minute. A table is published comparing the cost of the two systems; for a single-track overhead-trolley system the maximum cost is $45,000 per mile; for the open conduit system $57,000, and for the present contact system about $47,500, as a maximum; thus the latter is but little more expensive than the overhead equipment. As it is operated at 500 volts it may be combined with the overhead trolley system.

ACCUMULATOR TRACTION.—"Elek. Zeit.," Oct. 27.—A communication by Zacharias referring to the recent paper of Schiemann (see "Digest" Oct. 29). He claims the importance of discharging all the batteries in series, instead of dividing them into groups, is very great, and that the tests described are therefore unsatisfactory as far as it concerns the accumulators; there are difficulties involved in charging when the cells are unequally discharged. For indicating the amount left in the batteries he suggests the use of a voltmeter which is read while the current is being used; the lights in the cars would also give an indication. In a reply by Schiemann he said the tests were only made to study the action of the motors and not the batteries.

ELECTRIC TRACTION.—"L'Ind. Elec.," Oct. 25.—Abstracts from the report of the committee sent to the United States by the Orleans Railway, of France, to report on electric traction to replace steam on the steam railroads. Their conclusions are that although such installations are not numerous in the United States, the results have shown that no technical difficulties have interfered with their success; the practical success of the contact rail or wire with sliding contacts has been demonstrated; electric locomotives have been constructed of much higher power than is required for the heaviest trains on French railroads.

ELECTROLYSIS OF PIPES AT DAYTON. Brown. "Elec. Eng.," Nov. 3.—An abstract of a paper read before the Mun. Impt. Assn. at Washington. He refers to the recent tests in that city, which were noticed in the "Digest" Oct 22. He brings out the fact that formerly cast iron pipes were considered safe against electrolysis, but that these tests have shown that this is not the case in that city. Pipes from 1.5 to 2 miles from the power houses were subject to electric corrosion; near one power house the pipes were 9 volts positive to the rails; in his opinion all mains and service pipes in that city are seriously injured where subjected to 3 volts or more for two years or more, when within 4 feet of the rails. The tar covering on the pipes seems to be no protection whatever, as the surface of the pipes is changed into a soft black material resembling graphite. He believes that with an expenditure of $5000 to $7000 for proper electrical connections all water pipes in that city could be maintained negative to the rails; the pipes would then "harden" and any further electrolysis would add a layer of metal to them instead of injuring them. In conclusion he adds a few practical suggestions; it should not be imagined that because the pipes are not leaking or bursting that they are safe from electrolysis, for they may be getting weaker day by day; the best course to be adopted is mutual action; no more lead or wrought iron service pipes should be put down, but instead, wooden pipes with a close spiral of hoop iron covered with asphalt should be used; the same pipe should also be used for new mains in districts that might be affected; in danger districts two or more consecutive lengths of these wooden pipes should be inserted in the water or gas mains, thus breaking their electrical continuity; the space around them should be filled with broken stone and connected with a drain, if possible; midway between the wooden sections pilot wires should be attached, leading to a central office; also similar wires to the nearest rails; electrical tests should be made daily, and any section which is positive should at once be cut into smaller sections, and the railway company should rebond its line in that district.

MULTIPLE UNIT SYSTEM IN CHICAGO. Shepard. "Elec. Eng.," Nov. 3.—A short article on the Sprague system, used on the Chicago South Side Elevated Road, in reply to a recent criticism of Cravath. Elevated railroad service is essentially acceleration, as the rest of the energy is inconsiderable in comparison. In order to keep down the braking speed a low maximum speed is required and to obtain this in the shortest time a rapid acceleration is necessary. The limit to possible acceleration is not one of personal comfort, but of adhesion, and it can be accomplished only when every wheel of a train is a driver. The equipment is designed for a 15-mile schedule; the maximum possible current will develop a torque which is sufficient to come within the slipping point of the wheels. Such a system does not conduce to the lowest average current consumption, which is in excess of the ratio of the squares of the scheduled speeds; with ten seconds' stop at each station and an actual 15-mile schedule, the current consumption was found to be 1.54 kw hours per car mile. The locomotive system must operate at a low acceleration compared with independent cars. He fails to see how Cravath's criticism can hold for actual conditions of service; this was, that the use of so many small motors would give a lower efficiency than single-motor cars at the head of a train. As compared with the locomotive system the features of the multiple unit system are that for any given schedule the first cost is lower, the cost of operation is lower, there is greater facility for car movement at lower maximum speed, and there is greater resultant safety.

RECENT IMPROVEMENTS IN MECHANICAL TRACTION.—"St. Ry. Jour.," Nov.—An abstract of a paper read by Ziffer, of Vienna, before the meeting of the International Permanent Tramways Association at Geneva in August. He takes up the following subjects: Steam motors; stored steam locomotives; compressed air motors; cable railways; gas, benzine and petroleum motors; electric traction by accumulators; electric traction by overhead wires; electric conduit systems; mixed electric tramway systems; and service conduit systems; and describes briefly the improvements made during the last two years, and in a general way discusses the cost of operation. In his conclusions he states that while it would be impossible to fix upon any one system as the best without examination into the local conditions, it is undoubtedly true that the trolley system is the one most generally adopted, and is the most simple, the most economical and the one which has given in practice the best results up to the present time. The paper seems to be similar to the one noticed in the "Digest" Oct. 29.

SPECIAL CARS IN BROOKLYN.—"St. Ry. Jour.," Nov. 10.—Six cars are described. One is a special car employed by the superintendent in making inspections of the road. Two others are private parlor cars owned by prominent officials of the company; one of these has a novel portable turntable, consisting of a hydraulic jack carried underneath the car and used at crossings where there are no connecting curves. The car is run to the centre of the crossing and lifted up by the jack and then swung around by hand until the wheels are directly above the other track, when it is dropped into place. A fourth car is used in construction and line repair work. It has a tower, which can be raised and lowered

by a windlass, and a movable platform, all of which can be brought flat with the top of the car. In the interior are carried all materials required for building new line and for quick repairs. When used for putting up new trolley wire, the new wire is kept on a large insulated reel within the car, and the end is led out through the roof of the car over a brass pulley; the end of the wire is then clamped to the end pole or span wire, and the car proceeds, reeling out the wire. The wire is alive and the car proceeds under its own motive power, taking current from the new wire. When the first span or bracket pole is reached the car is stopped and the men on the platform make the connection between the wire and its insulator, and they then proceed to the next span or pole; this simplifies the work, as one mile of trolley wire can be taken down and new wire put up and all connections made in twenty minutes. The fifth car described is a convertible car, employed by the company. In plan it is constructed nearly like the ordinary open summer car, with ten cross seats, one on each platform; but the eight seats within the body of the car are arranged in pairs of two each, facing each other, making four open spaces. The entrances are all on one side. In summer the windows are removed, but in winter the car is inclosed with four side doors. The side windows are stationary in winter and cannot be lowered, but at each end are two large windows, which are movable. The company has 250 cars of this type. For transporting long (60-foot) rails it employs a special platform car. This car is 40 feet long, and is mounted on double trucks equipped with very small wheels. Two motor cars are used to move this car, one to push and one to pull it. This tends to prevent possible accident if one of the draw-bars should break on a grade. The draw-bars connecting the car with the motor cars are 15 feet in length.

GLASGOW.—"St. Ry. Jour.," Nov.—A description of a section of 2½ miles of trolley road recently built in Glasgow by the municipality. The rails weigh about 100 pounds per yard and rest on a concrete base about 6 inches deep. The power station contains three tandem compound engines, each connected with a 200-kw generator. The boilers are equipped with automatic stokers. The cars are mounted on double trucks, with entrance at the side of the car. Most of them are single-deck, but some are double-deck. The wheels are of chilled iron. The fares are graded according to the distance traveled.

ALGIERS.—"St. Ry. Jour.," International Edition, Nov.—This railway, which has a length of about 9 km, was put in operation last April. There are numerous grades, the highest being 8 per cent.; the gauge is 1.055 metres. The engines are horizontal condensing Corliss, two in number, and of 350 horse-power each. Each engine drives a 200-kw generator. There are eighteen motor cars and an equal number of trail cars; the motor cars are divided into two compartments, one for first-class and one for second-class passengers. Each compartment has room for ten seated passengers, and each platform accommodates ten passengers, making forty passengers for the car. The cars are equipped with two motors each, and electrical brakes.

THE GRATZ-MARIA TROST RAILWAY.—"St. Ry. Jour.," Nov.—This railway has a length of 5.2 km and a gauge of 1 m. In the power station are two six-pole, compound-wound generators of 135 amperes at 600 volts. There are eight motor cars and four trail cars. The cylinder dimensions of the engines are 280 mm and 400 mm by 220 mm. Superheaters for raising the temperature of the steam from 135° C. to 250° C. are used.

DUBLIN. Boyd. "St. Ry. Jour.," Nov., International Edition.—A review of the financial report of this company for the past year, with an estimate of future earnings.

HONOLULU AND ITS STREET RAILWAYS. Cicott. "St. Ry. Jour.," Nov.—A short, illustrated description.

EVAIN-LES-BAINS.—"St. Ry. Jour.," International Edition, Nov.—An illustrated description of this small three-phase railway plant. Other descriptions have already been noticed.

CENTRAL POWER PLANT.—"Sc. Am.," Nov. 12.—An illustrated description of the 70,000-hp power station of the Metropolitan Street Railway Company, of New York, including illustrations showing it in course of construction.

ORGANIZATION AND OPERATING METHODS OF THE UNION TRACTION COMPANY, OF PHILADELPHIA.—"St. Ry. Jour.," Nov.—The company's plan of organization is first described and illustrated by a diagram. The remodeled Thirteenth and Mount Vernon Street power station is fully illustrated. The new machines are compound non-condensing, and each connected to a 1500-kw, fourteen-pole generator. By a special construction the magnetic strength of the different field poles is kept equal, so that by means of a parallel-wound armature equal e. m. fs. are secured from all fourteen circuits. A field coil may then be short-circuited without interfering with the voltage. The shafts are of open-hearth steel. The switchboards, which are novel and complicated, are fully illustrated. The article is accompanied by a map showing the location of the abandoned stations and those in use.

RELATIVE COSTS AND PROFITS OF CABLE, ELECTRIC AND HORSE RAILWAY OPERATION IN NEW YORK.—"St. Ry. Jour.," Nov.—A carefully made technical and financial analysis of the last annual and quarterly statements of the Metropolitan Street Railway Company, of New York city, which during the year ending June 30, 1898, operated nearly 12,000,000 car miles by cable, over 7,000,000 by the underground conduit electric system, and nearly 16,000,000 with horses, a total of over 35,000,000 car miles. The company's private records of operating costs have been most carefully kept and correctly distributed to the different motive powers, so that the comparative statements are exhibited in the large table accompanying the article, which is a transcript of these private records. It is said to be the most interesting and valuable statement, based on the actual practice of the costs of operation by electricity and cable in the same city and under the same conditions, which has ever been published. The cost of electric operation for the year, with everything in a transition state, is shown to be 10.23 cents.; of cable operation, 16.42 cents, and of horse operation, 17.87 cents. For the 4,000,000 electric car miles run during the last three months, the cost of operation for the underground conduit system has been reduced to 10.05 cents.

BRITISH COLUMBIA RAILWAY.—"Railway and Shipping World," Oct.—Extracts from the accounts of this line for the year ending in March.

STREET RAILWAYS IN THE UNITED STATES IN THE HANDS OF RECEIVERS.—"St. Ry. Jour.," Nov.—A table giving names of companies, miles of track, number of cars, date of receivership, funded debt, gross receipts for last year obtainable, and the name of receiver..

MUNICIPALISM IN THE BRITISH TRAMWAY FIELD. McCallum. "St. Ry. Jour.," International Edition, Nov.—This tendency is shown by the recent offer of the municipality of Glasgow to build an interurban electric railway line between that city and a neighboring town. Glasgow already owns and operates its own tramway system. Municipal ownership and operation of tramways is common in England, but no effort has heretofore been made by a municipality to own and operate tramways or railways outside of its own boundaries. The city of Manchester is also proposing to follow the same course, and bills to secure the necessary permission will be presented at the next meeting of Parliament. The writer condemns the policy from both an economical and political standpoint, and states that municipally operated tramways have not proved as economical as those under private ownership.

CONDUIT CONSTRUCTION.—"St. Ry. Jour.," Nov.—A statement showing how about 12 miles of electric underground conduit construction was completed and put in operation within ninety days, in New York city.

THIRD-RAIL SYSTEM. Maxham. "Elec. Eng.," Nov. 3.—A brief, illustrated description of his system, which was exhibited at the Mechanics Fair in Boston. The conductor lies in a hollow rail, which is in sections, and is made alive by a mechanical device consisting of a wheel, which depresses a mechanism which connects the feeder to that section of the rail.

HANDLING BATTERIES FOR VEHICLES. Dolnar. "Amer. Mach.," Nov. 10.—An illustrated description of the plant for handling and charging batteries used by the New York electric cabs.

ELECTRIC CARRIAGES.—"West. Elec.," Nov. 5.—Some very brief descriptions of eight different vehicles made by the Fisher Company.

TENTH CONVENTION OF THE INTERNATIONAL TRAMWAYS ASSOCIATION. Ziffer. "St. Ry. Jour.," Nov.—An extended report, and claimed to be the first published, of the convention held in Geneva August 24-27. The subjects discussed were the proper length of car body, double trucks and radial axles, brakes, proper size of engines for railway power stations, rail bonds, storage batteries for traction, advantages and disadvantages of different electric tramway systems, and the relative advantages and disadvantages of all the mechanical methods of traction. A digest of the discussion is given, and the different points of electric tramway interest in the neighborhood of Geneva visited by the delegates are described and illustrated.

Installations, Systems and Appliances.

INTERRUPTION OF SUPPLY AT BRIGHTON.—Lond. "Elec.," Oct. 28.—A brief account and discussion of a recent interruption of half an hour. A 220-kw armature developed a short-circuit and for some unexplained reason all the dynamos running at that time immediately dropped their minimum cut-outs, thus interrupting the whole supply of 9000 amperes. The practice at that and at several of the largest stations in that country is to use no excess current cut-outs between the dynamos and the bus bars, but only minimum cut-outs; this would appear to afford an absolute safeguard against what actually occurred at Brighton; if excess current cut-outs or fuses were used with each dynamo a sluggishness of the minimum cut-out in the case of an armature short circuit would blow the excess current cut-outs of all the other machines; but for all the minimum cut-outs to act it was essential that the current from the dynamos must have been greatly reduced and this can only be explained by the behavior of the dynamos themselves. It is hardly probable that the short circuit sufficed to pull the machines up "dead" for an instant; the speed was probably greatly reduced, while a reaction of the large currents in the armature tended to weaken the fields, and it is just conceivable that these two causes reduced the current sufficiently to release the cut-outs. Another fact might have contributed to the remarkable results; two small machines were also running in parallel with the others, being provided with ordinary fuses and no minimum cut-outs; but these fuses did not blow; their speeds may have been less affected than that of the larger ones. To replace the minimum

cut-outs by return current cut-outs would probably be effectual, but there is a prejudice against their shunt winding; to separately excite the dynamos might lessen the probability of such an accident, although it may not be an absolute safeguard. For the present it is likely that the minimum cut-outs will be discarded in place of extremely heavy excess cut-outs.

CENTRAL STATIONS AND CONSULTING ENGINEERS.—Lond. "El'ty," Oct. 28.—A long series of four illustrated articles giving portraits and brief biographies of four consulting electrical engineers, followed in each case by an illustrated description of a plant designed by him. The following are the subjects: "Robert Hammond and the Leeds Electric Lighting Station;" "Prof. A. P. W. Kennedy and the Edinburgh Central Station;" "E. Manville and the Shoreditch Central Station;" "H. F. Parshall and the Tees-Side Electric Tramways."

HULL.—Lond. "Elec. Eng.," Oct. 28.—A brief, illustrated description of this plant, to which some 44,000 lamps of 8 candle power are connected. There are two high-pressure direct-current sets of 2000 volts, which is transformed down at sub-stations by direct-current transformers, the same as in the so-called Oxford system.

LLANDUDNO.—Lond. "Elec.," Oct. 28.—A brief, illustrated description of this lighting station which is worked in conjunction with a refuse destructor plant, although the generation of steam does not depend entirely on the refuse.

PARIS. Laffargue. "L'Ind. Elec.," Oct. 25.—A short summary of the changes made in the central stations in Paris during the past two years.

LARGE BATTERY.—"L'Ind. Elec.," Oct. 25, and "L'Elec.," Oct. 29.—A note stating that at Antwerp a Tudor battery has been added to the new station, consisting of 140 cells, having a capacity of 6090 ampere hours at a rate of 609 amperes; the normal charging current is 1500 amperes; it will give 1350 amperes during three hours, or 3000 on an emergency; the total power is 800 kw, and it is therefore thought to be the largest battery installed.

SMALL POLYPHASE STATION.—"Amer. Elec.," Nov.—An illustrated description of the Hackensack plant, which is said to be a good example of small multiphase installation. There is one generator of 350 kw giving three-phase current of 2500 or 5000 volts, and two smaller machines.

WASHINGTON. Hopkins. "Elec. Eng.," Nov. 3.—An illustrated description of the new station of the United States Company. The description refers chiefly to the mechanical and engineering features. The continuous-current three-wire system is used in connection with a storage battery having a capacity of 16,000 lamp hours at an eight-hour rate of discharge.

BROOKLYN.—"Power," Nov.—An illustrated description of the large 3000-hp steam-driven dynamo for this station; the description refers chiefly to the engine.

CHICAGO PUBLIC LIBRARY.—"Engineer," Oct. 15.—An illustrated description of the power plant.

UNITED STATES CRUISER NEWARK. Countiss. "Amer. Elec.," Nov.—An illustrated description of the electric equipment of this steamer.

LIGHTING ARRESTERS. Raymond. "Amer. Elec.," Nov.—Brief, illustrated descriptions of a number of different forms of lightning arresters. No comparison of the merits of the different forms is made.

Wires, Wiring and Conduits.

RULES AND REGULATIONS.—"Elek. Zeit.," Oct. 27.—A reprint of a short report made to the German Government by a committee of the Union of German Electricians, concerning the question of what voltage should be considered dangerous. Tests were made in a chemical factory where the workmen had to handle alkalies, acids and salts. Experience has shown that under normal conditions the insulation resistance of a human being is so high that voltages up to 250 are not dangerous; in order to determine the dangerous voltages under abnormal conditions, such as in these chemical works, a number of measurements were made of the insulation resistance of workmen, who were tested in the condition in which they were while at work. The electrodes were clasped in the hands and the resistance measured; under normal conditions values were found between 900 and 2000 ohms, and it is therefore not the case that the resistance diminishes by handling these chemicals. Great differences in insulation were found in the workmen under normal and abnormal conditions, and these are due to the footwear and the resistance of the floor; the shoes worn were mostly of wood. Under normal conditions the resistance from hand to earth out of twenty-four workmen was for seventeen about 150,000 ohms, for seven between this and 50,000, and for the others between 17,000 and 14,000 ohms. Under abnormal conditions the resistance varied greatly; values from 1700 to 900 were found; in another case 2400 to 1100; the mean under abnormal conditions is about 2000 to 3000, while for the normal it is about 100,000. It is therefore concluded that the rules and regulations which have recently been adopted in that country need not be altered for normal conditions; the portion referring to abnormal conditions, however, is very important. This refers to the continuous current, as at present it has not been determined whether the alternating current is any more dangerous.

RULES AND REGULATIONS.—"L'Elec.," Oct. 29.—A reprint of recent French laws concerning aerial conductors.

INTERIOR WIRING. Knox. "Amer. Elec.," Nov.—Brief descriptions of various systems of feeders and mains.

Electro-Physics and Magnetism.

CORPUSCULAR THEORY OF ROENTGEN RAYS. Walter. "Wied. Ann.," No. 9; abstracted in Lond. "Elec.," Oct. 28.—He works out a theory similar to that of Vosmaer and Ortt, the truth of which is said to appear obvious and palpable at first sight. He supposes that Röntgen rays are discharged cathode particles; they are therefore not deflected by a magnet; after striking the anticathode and discharging themselves they are reflected in a diffused manner and penetrate the walls of the tube. These particles must be much smaller than the electro-chemical ions. That Roentgen rays have a penetrating power is due to their electric neutrality; a copper bullet, for instance, could penetrate a forest of magnets easier than an iron bullet.

CURRENTS GENERATED BY ROENTGEN RAYS. Winkelmann. "Wied. Ann.," No. 9; abstracted briefly in Lond. Elec.," Oct. 28, and "Am. Jour. of Sc.," Nov.—He studied the property discovered by Perrin, that differences of potential are produced between two different metals when exposed to X-rays; a small constant current was observed.

RECOVERY OF ROENTGEN RAY TUBES. Machado. "Comptes Rendus," 126, p. 1341; noticed briefly in "Science Abstracts," Sept.—He wraps the tubes surrounding the stem of the cathode with a flexible metallic sheet of tin, lead or platinum, or surrounds it with an insulated coil of copper wires. With this arrangement it is claimed that exhausted tubes recover in a few seconds. No further description is given in the abstract.

ROENTGEN RAYS. Roentgen. "Ann. Phys. Chem.," 1, p. 18; abstracted at considerable length in "Science Abstracts," Sept.—This appears to be the same paper as was abstracted in the "Digest" a number of months ago.

LUMINESCENT LAMPS. Wiedemann. "Wied. Ann.," No. 9; abstracted briefly in the Lond. "Elec.," Oct. 28.—Before concluding that the luminescent lamp is the light of the future, it should be determined what the expenditure of energy is for producing this pure light. He therefore determined both the heating and the lighting of a luminescent screen by the impact of cathode rays. He found that the heating accompanying a brightness of one candle was about 1 gr. calorie per second, which means that only about 5 or 7 per cent. of the incident energy is converted into light. In the Puluj lamp the heating per candle power was 3 watts, which is very nearly that in the ordinary incandescent lamps.

VACUUM TUBES VS. COHERERS. Righi. "Nuovo Cimento," July; abstracted in the Lond. "Elec.," Oct. 28.—He describes a vacuum tube which he invented and which seriously rivals the coherer for detecting waves. The details are not given, as they are said to be too complicated; the tube shows a continuous streak of light, which breaks up under the influence of electric waves into positive strata, dark spaces, and cathode light; the cathode is a wire and the anode a disc; the conditions are resumed after the radiations cease; the effect is also produced when the radiation impinges on some portion of the circuit not too far away from the tube. Besides the optical phenomenon there is also a change of resistance, the current often increasing three times when the tube lights up. It has the advantage not to require a special mechanism for restoring the original resistance.

HERTZIAN WAVES. Holzmueller. "Elec. Rundschau," Oct. 15.—The beginning of a reprint of a long paper on the nature of Hertzian waves. It is not elementary in character.

CONTACT ELECTRICITY. Murray. "Roy. Soc. Proc.," 63, p. 113; abstracted at some length in "Science Abstracts," Sept.—An experimental investigation to elucidate and measure the variation of contact electricity due to changes in the state of that portion of the surface of each conductor which was separated from the other by an insulating medium.

ALTERNATING-CURRENT CALCULATIONS.—Lond. "El'ty," Oct. 28.—The first of a series of articles on the arithmetic of alternating-current distribution in the form of problems and their solution. The graphical method will be used largely, and a knowledge of the ultimate principles of working is supposed.

TWO PHYSICAL HYPOTHESES.—"L'Ind. Elec.," Oct. 25.—A brief criticism by Brylinski of the recent paper by Juppont (see "Digest" Nov. 5). He claims that the first hypothesis is based on an error of definition, and that the second one is also based on an error. This is followed by a long reply by Juppont, in which he gives a supplementary explanation. In an editorial note it is claimed that the differences are due chiefly to a confusion between physical magnitudes and the units which serve to measure them.

LIGHT FROM ELECTRODES IN ELECTROLYTES. Braun. "Wied. Ann.," May; abstracted in "L'Eclairage Elec.," Oct. 22.—When an alternating current is passed through an aluminum electrode in sulphuric acid a phosphorescent light is produced at the electrode; this he investigates.

CONDUCTIVITY AND DISSOCIATION. Noyes. "Zeit. Phys. Chem.," 26, p. 699; abstracted briefly in the "Zeit. f. Elektrochemie," Oct. 27.—A criticism of the claim of Van Laar that the measurements of conductivity are not a good means of measuring the electrolytic dissociation; the present writer claims they are.

THE MOHEGAN DISASTER AND MAGNETIC DISTURBANCES. Ruecker. Lond. "Elec." and "Elec. Rev.," Oct. 28.—A few notes from a daily paper in reply to the suggestion that the wreck of this steamer may have been due to local deviation of the compass. He states that such deviations are more likely to occur on land near the disturbing cause than at sea, where they must be separated by a greater distance. It is not impossible that the compass of a ship in relatively deep water might have been appreciably affected for a distance of 3 or 4 miles by a concealed centre of magnetic disturbance; one such case is cited. As no disturbance on land was noticed in this case, it is not likely that this was the cause.

MAGNETIC HYSTERESIS. Neithammer. "Wied. Ann.," No. 9; abstracted briefly in Lond. "Elec.," Oct. 28.—An abstract of an article which appears to be the same as the one already noticed in the "Digest" Oct. 29 and Nov. 5.

RELATION BETWEEN STRUCTURAL AND MAGNETO-OPTIC ROTATION. Wright and Kreider. "Am. Jour. of Sc.," Nov.—They investigated experimentally "whether, if the optically active molecular structure or aggregation were affected in a magnetic field, it would be influenced thereby to an extent sufficient to show in its final optical properties, which would seem probable, providing the interatomic or intramolecular forces are electrodynamic." The results show no marked and indisputable evidence of the influence of the magnetic field upon actively optical structure, but they seem to indicate a disturbance of the equilibrium by the magnetic field.

CHANGING CATHODE RAYS INTO LIGHT. Wiedemann. "Wied. Ann.," 9, p. 61; noticed briefly in the "Am. Jour. of Sc.," Nov.—He measured the proportion of energy of the cathode rays which is converted into light rays, and found that this proportion was of the same order as that in the case of photo-luminescence, and is very small. (This is apparently the same article as the one noticed above.)

RESISTANCE OF IRON WIRES. Merritt. "Elec. Eng.," Nov. 10.—A very brief abstract of his A. A. A. S. paper. He gives the results of measurements made by Denio of a number of different iron wires, so as to determine their resistance with alternating currents of 135 pounds, and with direct currents. For small currents the resistance was the same, but as the current increased that offered to alternating currents became greater, reaching a maximum; the greatest was usually about three times the normal; for very heavy currents the resistance again decreased, owing probably to the partial saturation of the outer layers of the iron.

A. A. A. S. MEETING.—"Science," Oct. 31.—Titles of the papers at this meeting, with brief abstracts of some of them. Quite a number of the papers are on electrical subjects; they are too numerous to be noticed here separately. In one on hysteresis by Thiessen he showed that the hysteresis loss for constant magnetizing fields increases with the temperature if the field is weak, but the opposite is the case when the iron is nearly saturated. In one on determinations of dielectric strength by Gray he showed that the dielectric strength of air is the same for alternating currents of ordinary frequency as it is for static charges. In one on polarization in the zinc, zinc-sulphate cell, by Anthony, he shows that what is called polarization is not dué to the accumulation of hydrogen, but to the fact that the hydrogen originally dissolved in the acid and condensed on the plates has been used up. In one on the electrical resistance of lead amalgams at low temperatures by Gressman he shows among other things that there is a sudden decrease of resistance on solidification.

SILICON AND MAGNETIC PERMEABILITY. Caldwell. "Science," Oct. 31.—A brief notice of his A. A. A. S. paper, in which he shows that the permeability increases with the amount of silicon present in the iron.

Electro-Chemistry and Batteries.

ELECTROLYTIC NICKEL. B. C. Kershaw. Lond. "Elec. Rev.," Oct. 28.—A short article. He believes the electrolytic refining of nickel will be as important in the nickel industry as that of copper is in its industry. Foerster, in an article recently noticed in the "Digest," endeavored to find the conditions for obtaining thick deposits when the anodes contained comparatively small percentages of impurities, and he found that foliation and sealing were avoided by using hot solutions of the sulphate, the temperatures being 50° to 90° C. The deposits were not as good from the chloride. Neumann, in an article recently noticed in the "Digest," made experiments with copper-nickel alloys in solutions of the sulphates. At 20° to 30° C. and with 0.50 volt, copper alone was deposited when the solution was acid; if it is then made alkaline, the nickel will be deposited, but filtration is necessary to remove the iron precipitated by the alkali. The Canadian Copper Company, at Cleveland, U. S. A., produces electrolytic nickel by a secret process; it is supposed that the copper is first deposited and the remainder is precipitated chemically; besides this there are two other firms, one in Germany and the other in Russia, who are producing electrolytic nickel. The present output of nickel in the world is 4000 to 4500 (what?) per annum, and the average price of the fine nickel in the United States was 34.62 cents per pound in 1897. A new process for the production of nickel direct from the ores is under consideration in this country; it is an electro-metallurgical one and is referred to in The Electrical World, July 2, p. 7.

COPPER-DEPOSITING PROCESS.—Lond. "Elec. Rev.," Oct. 28.—A number of communications regarding the Dumoulin process (see "Digest" Nov. 12 and 5). According to Kershaw's description, the idea of using fatty rubber is now abandoned; but the process of burnishing with soft rubber was patented years ago. It appears to have been found necessary now to exclude all fat and grease from the sheepskin rubbers; in France the Elmore process is now very remunerative and is a great success, as the profit last year was over a quarter of a million of dollars, while this year it will be much larger; this was due to a sufficient working capital.

CARBIDE FURNACE. Memmo system. "Zeit. f. Elektrochemie," Oct. 27.—An illustrated description of this furnace.

IMPURITIES OF CALCIUM CARBIDE. Moissan. "L'Eclairage Elec.," Oct. 22.—A reprint of an Academy paper.

RAPID-CHARGING CURVES FOR ACCUMULATORS. Girault. "L'Ind. Elec.," Oct. 25.—An article in which he deduces mathematically an equation which gives the value of the current when Planté accumulators are charged rapidly from a source of constant voltage. The equation is in the following form: The current at any given time is equal to a constant plus a coefficient multiplied by the voltage raised to a negative power, the index being a constant multiplied by the time; the algebraic values for these constants are given; they contain such factors as the active surface of the positive plate, and that of the peroxide before and during the charge. It applies to any voltage, provided it is not too great. He then applies it to a Blot accumulator, giving the results of the calculated and observed values; these curves seem to agree remarkably well with each other.

ACTION OF ACCUMULATORS. Hoppe. "Elec. Rundschau," Oct. 15.—He discusses the theory in connection with the van't Hoff and Arrhenius theories. He concludes that the accumulator is a true reversible cell which should operate without loss if it were possible to obviate the concentration currents. In order to increase the efficiency of accumulators one should therefore give attention to the differences of concentration, as all other methods will be of no avail.

Units, Measurements and Instruments.

GALVANOMETER COILS. Fabry. "L'Eclairage Elec.," Oct. 22.—An article on the magnetic field at the centre of a cylindrical coil and the construction of coils for galvanometers. In constructing such coils it is necessary to calculate the proportions which under given conditions will give in the central portion the most intense magnetic field. The solution afforded by Lord Kelvin is not satisfactory, and the present writer solves the problem in a more direct way. He assumes a cylindrical coil wound with uniform wire and calculates tables and curves which enable one to find rapidly the value of the magnetic field and therefore to find the most favorable conditions for producing the maximum field. The author assumes the interior diameter to be given; the best results will be obtained by making the external diameter 3.09 times, and the length 1.88 times the internal diameter. But without affecting the intensity of the field appreciably one can depart considerably from these dimensions, assuming, however, that in each case the cross-section of the wire is so chosen that the resistance has the desired value, namely, equal to that of the external circuit. It is an advantage to use wires of successively larger diameters for the outer layers, as in this way the constant of the coil may be increased about 60 per cent.

MEASURING ENERGY IN THREE AND FIVE WIRE CIRCUITS. Bary. "L'Ind. Elec.," Oct. 25.—A short article in which he gives briefly the approximate formula for the power in five-wire circuits based on the assumption that the voltage is the same on all four branches, but that the total voltage may vary; in that case the power is equal to the mean voltage—that is, one-fourth of the total—multiplied by the sum of the following currents: Twice the first, plus the second, plus the fourth, plus twice the fifth, referring to the currents in each of the five wires. In a meter, therefore, the windings which carry the currents in the outside wires should be double those for the currents in the intermediate circuits, and there is no winding for the middle wire. The formula is not quite correct and the error is always to the disadvantage of the consumer; this he shows. The plants should therefore be so arranged that the currents in the intermediate wires are practically negligible. In the three-wire system the error becomes greater the smaller the neutral wire.

BREAKS IN SUBMARINE CABLES.—Lond. "Elec. Rev.," Oct. 28.—An abstract of the article by Murphy (see "Digest," Oct. 15), followed by a criticism. It is claimed that Schaefer not only did not disprove the strict accuracy of Kennelly's law, but results appear rather to establish the law; moreover, the values of x calculated by Schaefer's formula are often more exact without the correction mentioned by Murphy.

SIMPLE MEASURING INSTRUMENTS. Child. "Amer. Elec.," Nov.—Illustrated descriptions of simple forms of volt, ampere and watt meters.

Telegraphy, Telephony and Signals.

ELECTRIC BELLS. Ebel. Lond. "Elec. Rev.," Oct. 28.—Brief, illustrated descriptions of recent progress, which is chiefly in the nature of cheapness of construction and in the use of dry batteries. A water-tight rattle is described; also a burglar alarm for closed circuit work; also a new form of alarm to be used with very large gongs; in this the bell is struck by a movable core of a solenoid, which is on roller bearings and is attached to a spring; it produces

one blow on closing the circuit and another on opening; there is no circuit-breaker, but a device for continuous ringing is briefly described; it is wound up and is at the push-button end.

TELEGRAPHS AND TELEPHONES IN PERSIA.—"Jour. of Soc. of Arts," reprinted in Lond. "Elec.," Oct. 28.—A short account of their development and present state.

AMERICAN TELEPHONE PRACTICE. Miller. "Amer. Elec.," Nov.—In this continuation of his serial he gives illustrated descriptions of a number of protective devices.

SUBMARINE TELEGRAPH CABLES. Webb. "Elec. Eng.," Nov. 10.—A long review of the recent large work by Bright, and including numerous interesting abstracts from it concerning the history, the construction and the working of submarine cables.

Miscellaneous.

ELECTRIC HEATER. Reyval. "L'Eclairage Elec.," Oct. 22.—An illustrated description of the Le Roy system. For the heating material he uses what he calls a "log" (Fr. buche) or rod made of agglomerated silicon as pure as possible. It is contained in a glass tube and the ends are provided with suitable terminals, so that these tubes can readily be inserted in spring clamps, which act as terminals; the tubes are exhausted. The temperature of the rod is about 700° to 800° C.; the oxidation of the material is prevented by the exhaustion of the air. The advantages claimed are that it replaces very long and fine wires, as its resistance is very high; the resistivity is about 1400 times that of carbon and more than 200,000 times that of German silver. For the same amount of energy, therefore, its length may be made less and the cross-section greater than that of a wire or carbon, thus making a more practical form of apparatus; the quantity of energy per unit of surface is much greater. Several forms of apparatus are described.

ELECTRICITY AND RHEUMATISM.—"L'Elec.," Oct. 29.—A note stating that Dr. Lindermann, at a recent medical congress, stated that he had made a number of cures of very severe cases by the use of the dry heat from an electric heater. The heat is produced in a closed vessel into which the affected member is placed, the temperature being increased up to 150° C. The worst cases require a dozen treatments.

PARIS EXPOSITION.—"L'Elec.," Oct. 29.—A brief description of the water castle and luminous fountains which are to form one of the attractive features at this exposition.

CURRENT STRENGTH OF LIGHTNING. Wurts. "Elec. Eng.," Oct. 27.—A short article on some recent observations in the Catskills. In one case the lightning struck a tree 200 feet from a hotel, passed down part way, then jumped to a telephone wire, setting the booth on fire, and finally grounded through a gas pipe, although the hotel was well protected by lightning rods; the current was not sufficient to melt the telephone line wire; he estimates that the current strength was at least hundreds, if not thousands, of amperes; one of the remarkable features is that it should leave the tree and pass through several hundred feet of horizontal iron wire and jump through air spaces instead of following the lightning rods. Another stroke passed part way down a tree, but then jumped to a neighboring fence post to ground in preference to passing through the roots.

LIGHTNING STROKE.—"Elec. Eng.," Oct. 27.—A photograph of a lightning stroke, showing some peculiar effects, which are discussed by Prof. E. Thomson. The lines appear blurred in a certain direction, and he believes this was produced by a motion of the camera. He considers it a common mistake to assume that a lightning discharge occupies an exceedingly brief time, and cites cases in which a trail was left in the air for a few seconds, long enough to be shifted and distorted by the wind; moreover, lightning discharges repeat themselves sometimes with great rapidity along the same path. He believes it a mistake to suppose that all lightning discharges are of the nature of very high frequency currents; some doubtless are, but it is probable that the oscillations are sometimes slow, sometimes fast, or that there are no oscillations at all.

PARIS EXPOSITION.—"Elec. Eng.," Oct. 27.—An illustrated article showing views of the grounds, giving the classification of the exhibits and other similar information.

ELECTRIC SIREN.—"Amer. Elec.," Nov.—A short article calling attention to the great inefficiency of whistles and suggesting a more economical substitute for plants, in which a motor and an air compressor are used for operating a whistle or siren. If a thin sheet of iron be placed over an alternating-current magnet a most piercing, penetrating noise will be emitted, which can be heard for miles, especially if provided with a device of the megaphone character. It would be very much lighter than the electric compresser, would not be less efficient, and has the advantage that it may be controlled from a distance.

ELECTRICAL PARADOX. Blake. "Amer. Elec.," Nov.—If a battery having 1.5 volts be connected to a conductor carrying a large current, at two points between which the drop of potential is 1 volt, but of opposite polarity to the terminals of the battery, then it will appear that the main current would be stopped by the small battery because it is impossible to have two currents in opposite directions in the same wire. If this is true it would also be true for a much smaller battery applied to points nearer together. He admits that the result cannot be credited.

The Inductor Alternators of the Royal Electric Company.

A new competitor in the manufacture of alternating-current generators has entered the lists in the Royal Electric Company, of Peoria, Ill. This company has designed a line of inductor machines, well enclosed by the cast-iron of the stationary armature and with a graceful and pleasing contour. The machine is of the central-fixed concentric field-coil type, with two rings of outwardly projecting steel poles, one polarity to either side of the field winding, throwing out the lines of force radially to two inwardly projecting rings of laminated armature teeth wound as usual, with machine-formed coils fastened in the slots by keystone-shaped wedges. The armature coils are attached to each other with connectors, and any one or more may be, of course, promptly cut out in case of trouble. The terminal panel on the side of the machine is fitted with a cover to prevent accidental exposure to the high-voltage terminals. The regulation is stated to be within 2 to 5 per cent., depending on the size of the dynamo. The machines before shipment are subjected to a high insulation breakdown test, those for 1000 and 2000 volts being tested for five times their normal voltage, respectively.

A New Binding Post.

The following illustrations show a new binding post which is manufactured by the Williams Electric Company, Cleveland, Ohio, under patent owned by the company, and applied to its double and single pole receivers and the magneto bells.

Fig. 1 is an elevation in one direction. Fig. 2 is the cross sectional in showing how the binding post is applied to the cabinet work of the magneto bells.

The body or base piece of the binding post is formed from spring sheet Craig silver, and has turned up from the same piece of metal two spring slips, *s*, which form a saddle or rest for the receiver-cord tip, *t*. Screw *b* on being rotated in the right-hand direction screws through the nut until one side of

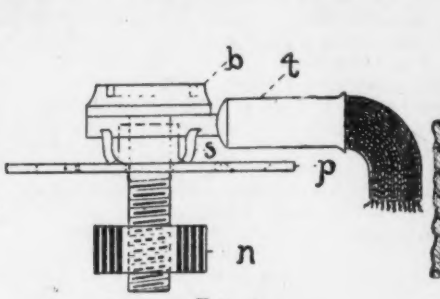


FIG. 1.

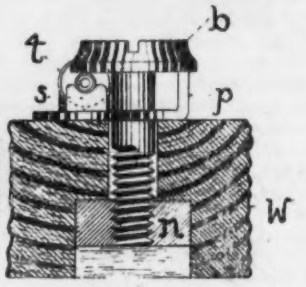


FIG. 2.

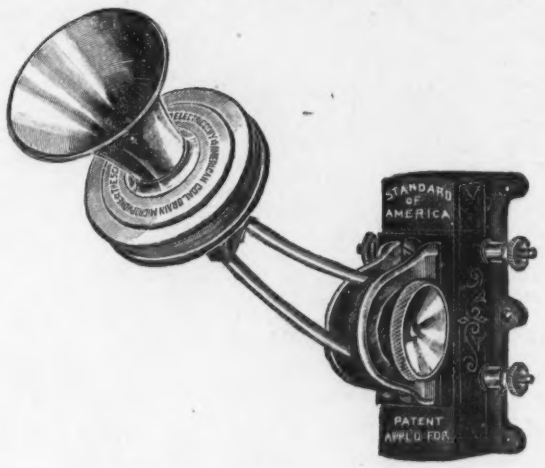
the screw head grips the receiver-cord tip *t*, and on further rotation the screw locks the connection, screw *b* forces down the spring saddle *s* by spreading the limbs slightly outwardly until the screw engages the upwardly-turned flange or base piece *p*, and in this manner forms a perfect spring lock for the receiver-cord tip.

Fig. 1 shows the binding post just after the screw head has engaged the receiver-cord tip. Fig. 2 shows the binding post after screw *b* is forced down until it engages flange *p*; resistance is offered to the movement of the cord tip in either direction by the tendency of either one of the limbs to straighten up and grip the cord tip still tighter.

An Improved Adjustable Telephone Arm.

The Schmidt & Bruckner Electric Company, New York City, is now placing upon the market a new style of adjustable telephone arm, which embodies several new departures from the ordinary black enameled arm.

The principal objection of the standard arm is the cord adjustment on the side. This has been the bugbear of many a telephone inspector on account of the liability to broken and poor connections. The inartistic appearance of



ADJUSTABLE TELEPHONE ARM.

the arm has also caused much contention. The Schmidt & Bruckner Electric Company has constructed and applied for a patent on an arm that overcomes the above-named objections, and combines, it is claimed, excellence in electrical and mechanical design with an unequalled handsome appearance.

Two strong steel rods connect the transmitter with the base and serve as conductors for the two sides of the circuit. At the base these rods are set in

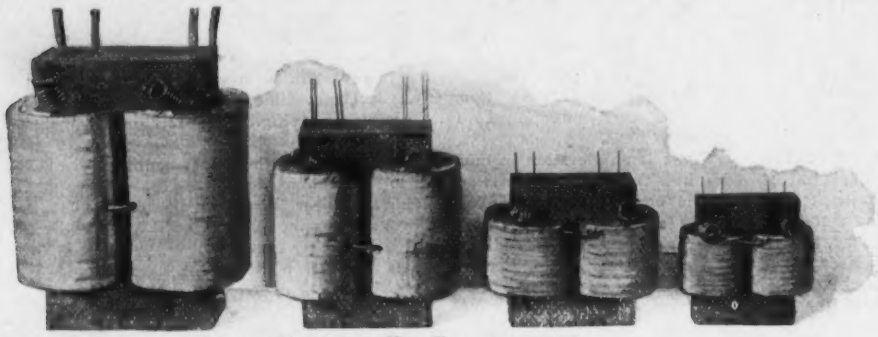
a hard-rubber socket, and connect with springs on the inside of the socket. These springs are of phosphor bronze, V-shaped and make rubbing contacts with the side flanges, and thereby allow for full play of the arm. A heavy finger nut of special make regulates the pressure of the springs and tension of the arm. The flanges are fastened to a block of hard rubber on the front of the coil box, and thus are insulated from each other. In the base is set a specially wound coil easily removed when repairs are necessary.

The transmitter is of the American coal-grain pattern, and may be detached from the arm by the removal of one screw. All parts, in fact, are distinct in themselves, and may each be removed separately.

This arm the company claims is a distinct advantage over other forms of arms, as it materially cheapens and quickens repairs.

A New Line of Transformers.

The Lakon Company, of Elkhart, Ind., has just published a booklet in which is described a new line of transformers recently placed upon the market by this company. These transformers are of the oil type, and although they



7½, 4, 1½ and ½ Kw Transformers.

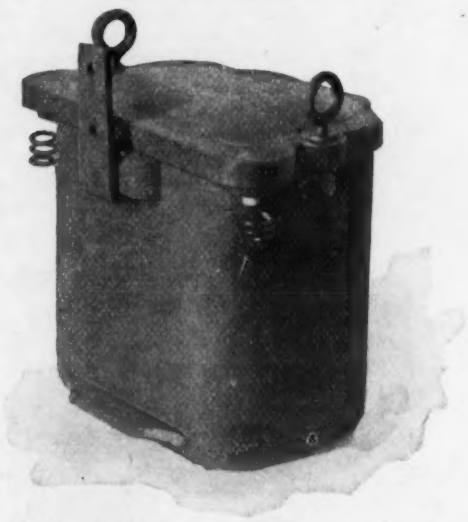
may be used without oil the company strongly advises the use of oil in all sizes, since it aids in the dissipation of heat and prevents the deterioration of insulation due to high temperatures. A pair of very strong and simple all-porcelain fuse boxes is furnished with each transformer. The method of hanging is very simple. The light Lakon hanging hook can be held in position, and lag screws and bolts put in place by one man, and when the transformer is raised to be hung upon the hook it can be swung into any position and quickly and easily lowered into the hanging hook.

A transformer having a high full-load efficiency will not necessarily have a high all-day efficiency, and it is the all-day efficiency which is important. In order to secure such an efficiency, these transformers have been designed for a very low core loss, and good regulation is secured by a simple arrangement of the windings and a liberal use of copper. The primary and secondary cables are brought out on opposite sides of the case through heavy porcelain bushings, and are firmly cemented into the porcelains so that there will be no chafing or wearing away of the insulation where the cables come through the case.

The aging of the iron has been investigated by this company, and it will replace within two years any transformer that shows any marked change in efficiency due to this cause.

In the Lakon transformer the coils are so arranged that a very large surface of copper is exposed to the oil so that the temperature is kept down to a very low degree.

The transformers are designed to withstand a high breakdown test between the primary and secondary and between primary and core. While a very high insulation between primary and secondary is a safeguard against burn-outs



Rear of Case Showing Hanging Device.

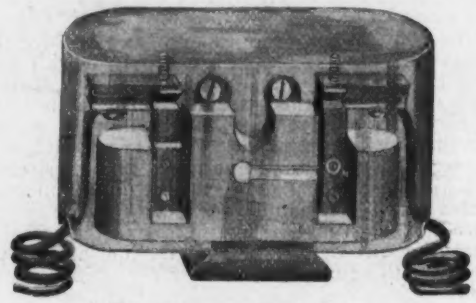
from lightning, a transformer cannot be made in which the insulation in itself is enough to withstand the extremely high potential of a lightning discharge, and the company advocates a more general use of lightning arresters. Metallic ground shields will be placed in transformers when specified, but their use is not advised on account of the increased danger of a puncture in the insulation due to a lightning discharge. The ground shield being connected to earth affords a free path for lighting, and the company believes that the transformer is more liable to be burned out by lightning when ground shields are attached. The ground shields will prevent the lightning discharge from appearing on the secondary circuit, but it is not a protection to the transformer.

The company manufactures transformers for alternating-current arc lamps, step-up and step-down transformers and transformers for special purposes, such as electro-cautery, electric welding or testing purposes.

A Power Circuit Arc Lamp.

Following next in the line of enclosed arc lamps developed by the General Electric Company a substantial, simple and efficient power circuit lamp has been perfected for use two in series on 220-volt circuits, or five in series on 500-volt circuits. It is manufactured in both single and double globe types.

To conform to insurance regulations covering the use of arc lamps on high voltage circuits a safe, positive and reliable cut-out is incorporated in the lamp, together with an extra set of resistance coils. Should the carbons stick or the lamp for any reason fail to operate, the cut-out sends the current through these subsidiary resistance coils instead of through the carbons, without detriment to the lamp. The efficiency of this cut-out has been demonstrated by cutting out lamps in circuit and allowing them to remain cut out for several consecutive hours, without resultant injury either to coils or lamp. The carbon is fed by a double-cam clutch, smooth and positive in action. An adjustable resistance in the upper part of the lamp allows it to be employed two in series on circuits of 200 to 240 volts or five in series on circuits of 500 to 600 volts. With one 12-inch positive and one 5½-inch negative one-half inch carbons it burns after one trimming for from 130 to 150 hours, and after the run



Transformer Fuse Box.

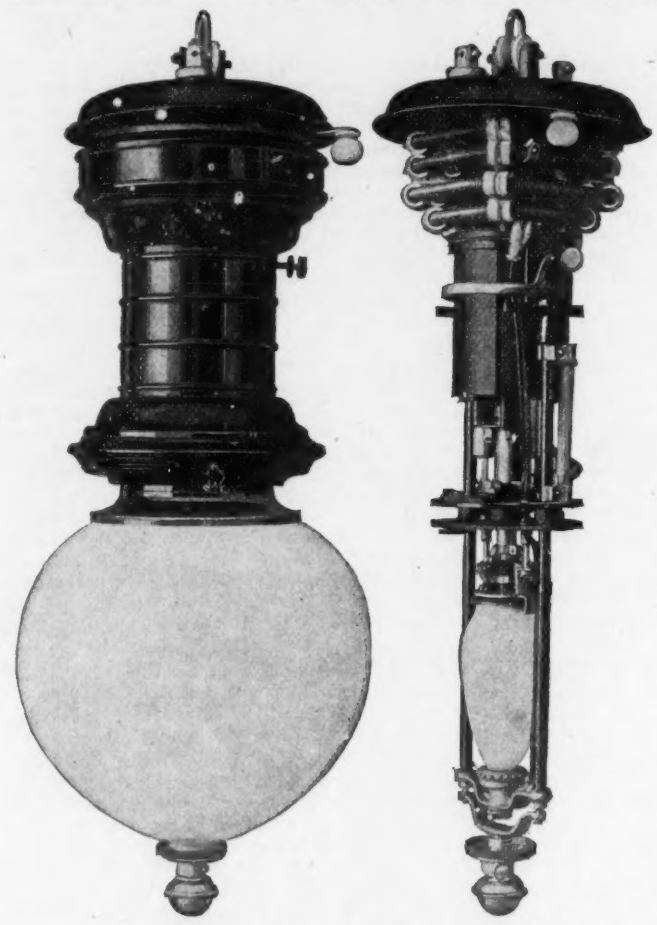


Fig. 1. Fig. 2.

the remainder of the positive carbon can be used in the lower carbon holder for a second run of equal duration. The current required is five amperes.

The lamp is furnished with the globe lowering device, which, it is stated, has been fitted to over 30,000 General Electric enclosed arc lamps, and which permits the globe to be lowered gently by merely turning a milled thumb screw at the side of the casing. Power circuit lamps are furnished in weatherproof black or brass casings. Fig. 1 shows the weatherproof casing and Fig. 2 the internal mechanism.

Special Correspondence.

NEW YORK NOTES.

THE NEW YORK ELECTRICAL SOCIETY.—At the next meeting of this society, which will be held at the College of the City of New York, Lexington Avenue and Twenty-third Street, at 8 P. M., November 17, Mr. E. H. Johnson will lecture on "Surface Contact Railways, with Special Reference to the Johnson-Lundell System."

MR. JOHN T. McKEEVER, JR., was a member of the committee of arrangements for the theatre party referred to in THE ELECTRICAL WORLD of November 5, and is also a member of the permanent committee appointed to look after similar affairs in the future. His name was inadvertently omitted from the committee membership list published in the issue referred to. He did excellent work on the committee.

MESSRS. H. B. COHO & CO. have given up their quarters at 30 Cortlandt Street, New York. Mr. Coho has opened an office at 143 Liberty Street, where he will act as New York manager of the Eddy Electric & Manufacturing Company, of Windsor, Conn. The affairs of H. B. Coho & Co. are in a rather complicated condition, and a meeting of creditors has been called to determine the future of the business.

TECHNISCHER VEREIN VON NEW YORK.—The regular monthly meeting of the Technical Society of New York was held Saturday evening, November 12, at the headquarters in Congress Hall, 192 Third Avenue. The paper of the evening was one presented by C. G. Buchanan, entitled "Zerkleinerung und Magnetische Reinigung von Erzen"—"The Pulverization and Magnetic Concentration of Ores."

BROOKLYN ELEVATED PROPERTIES SOLD.—On Thursday of last week were sold under foreclosure proceedings to Mr. F. B. Olcott, the Brooklyn Elevated Railroad, the Union Elevated Railroad and the Brooklyn Bridge & Seaside Elevated Railroad. Mr. Olcott is president of the Central Trust Company and chairman of the committee having in charge the reorganization of the railroads named. The proceedings were taken on behalf of the Central Trust Company. Mr. Olcott made one bid on each of the roads as follows: The Brooklyn, $1,750,000; the Union, $3,075,000, and the Seaside, $682,500. The consolidated company will be known as the Brooklyn Union Elevated Railroad Company, and it is stated that Mr. Frederick Uhlmann, the present receiver of the three roads, will be elected president of the reorganized company.

THE ELEVATED ROAD'S LOST BUSINESS.—The annual report of the Manhattan Elevated Railroad Company, while not having any direct bearing on electrical interests, is peculiarly interesting to electric railway people as showing the effect of improved street surface transit upon the business of the elevated road. The gross earnings (the report covers the year ended September 30 last) as compared with those for the previous year show a loss of $155,266, and the net earnings decreased $93,916. Apart from the financial aspect of the report the most significant feature is the decrease in the number of passengers carried, the loss being 3,556,500. This, however, probably does not represent the actual loss, because the aggregate number of passengers carried on all lines is rapidly increasing from year to year, and if the company had held its own against the competing surface roads the number of passengers carried would not have been the number carried in 1897, plus the 3,556,500 lost this year, but an increase over this sum, representing the company's share of the increased business. Of course, the surface lines got all of the additional business, besides that lost by the elevated road. The latter concern has been showing negative results ever since the underground system was laid down on the surface roads, and there is no reason to doubt that the losses will continue in an increasing ratio as the new electric surface lines are opened up. It is evident that radical improvements over existing methods of operation will have to be introduced in order to meet the advantages offered by the surface lines in convenience of access to the cars and speed. The adoption of electric power on the elevated road and quicker transit between stations would, partially at least, retrieve the lost business.

THE NEW ELECTRIC LIGHT, HEAT & POWER COMPANY.—If rumors indicate anything progress in the affairs of the recently organized New York Gas, Electric Light, Heat & Power Company is keeping apace, and if the company is as busy as the various reports would seem to indicate electric lighting interests in Greater New York are soon to lose their present identities and become constituent elements of one vast organization. THE ELECTRICAL WORLD has kept its readers informed as to developments in connection with this new enterprise, as interpreted from the standpoint of the interested outsider, and as time passes and new theories of the company's plans arise it is likely that the truth is being gradually approached in one direction or another. One of the latest reports anent the situation is that the electric lighting companies in Greater New York, with one or two exceptions, have now passed or are rapidly passing into the control of a single syndicate. According to this story the Mount Morris Electric Light Company has just been acquired. It is pointed out that in view of the purpose and ability of the electric traction companies of Greater New York to manufacture and sell surplus power the possibilities for electric lighting are greater now than ever before. In this connection it is interesting to note the report that the Metropolitan Street Railway Company has made an arrangement with the Consolidated Telegraph & Electrical Subway Company whereby the latter concern shall have the use of the ducts now being laid by the railway company. The fact has been pointed out in these columns that the Metropolitan Street Railway Company in advancing its new electric work is laying a large number of ducts, apparently far in excess of its own requirements. Whether the report last referred to be true or not it certainly has the appearance of a reasonable explanation for the use of so many ducts. The Third Avenue Railroad Company is also preparing to lay a large number of ducts in connection with the reconstruction of its lines to the underground conduit system. This matter was more particularly referred to in the last issue of THE ELECTRICAL WORLD. If, as reported, the Metropolitan Company, has rented or leased its surplus ducts to the Subway Company, the Third Avenue Company, too, will probably have ducts to rent.

THE PEOPLE'S TELEPHONE CORPORATION OF NEW YORK is soliciting orders for its service. Its message service rates, as shown on the order blanks, are as follows:

No. Messages.	Rate.	Additional Messages.
*300	$22.50	10c.
400	30.00	9c.
500	37.00	8c.
600	43.00	7c.
700	48.00	6c.
800	52.00	5c.
900	56.00	4c.

*Residence only.

All instruments installed under the order are to be efficient, long-distance telephones on metallic circuits, connected with the central office or exchange by private wires; extension telephones on the same line and within the same building will be furnished at $1 per month, and the schedule rate for calls, no charge being made for installation; original installation without cost to the subscriber. The order covers a period of five years, during which time the company agrees that it will not increase the charge to subscribers for telephone service. The company agrees to maintain uninterrupted service (accidents, the elements and action of the authorities excepted), and to allow subscribers pro-rata rebate for all interruptions exceeding forty-eight hours, after notice in writing. Among the inducements offered the company promises a superior system, rapid service, new instruments and first-class modern equipment throughout; a charge of $100 per year for unlimited service, with 100 free coupons good for use at any pay station; an arrangement with message service subscribers by which they receive a liberal division of pay-station tolls; a private line residence service as low as $30 per year; a group-line residence service, unlimited calls, at $1 per month. A statement of the benefits of a five-year order for unlimited service is given. It shows a cost in that time of $450, after deducting the value of 500 coupons at 10 cents each. This, the statement represents, means a saving of $750 to the subscriber for five years' service, as compared with the charge made by the existing company for similar service.

NEW ENGLAND NOTES.

THE ANNUAL MEETING of the West End Street Railway Company will be held in Boston on November 22.

MR. J. H. HALLBERG is the designer of the handsome line of lamps now on exhibition by the Standard Thermometer & Electric Company at the Mechanic Fair in Boston. In the issue of November 12 it was stated that these lamps were designed by Mr. Upton. Mr. Upton writes to say that this is not the fact, and that the lamps were all designed by Mr. Hallberg, the electrician of the company.

MOTOR-CARRIAGE CONTESTS.—An interesting competition between various types of motor carriages took place at the Charles River Park, Cambridge, on the afternoon of November 9, under the auspices of the Massachusetts Charitable Mechanic Association. Prizes to the value of $1100 were offered by the management, and a large number of people witnessed the novel spectacle, which certainly proved to be a very interesting attraction. The various carriages paraded from the Mechanics Building to the park and then around the circuit of the track, passing in review before the spectators. In the parade were vehicles representing the electric, steam and gasoline methods of propulsion. The first event was the speed contest, a two-mile pursuit race. No electrical vehicles took part in this race, which was won by the De Dion gasoline tricycle in 5 minutes and 1 2-5 seconds; the Whitney steam carriage came in second. In the brake-efficiency contest the Riker electric carriage, made by the Riker Electric Motor Company, of Brooklyn, took the first prize, stopping at 6 feet 1 inch, the Haynes gasoline carriage taking second prize. The next contest was as to manageability, and was won by the De Dion tricycle. The Riker electric carriage, which was 4 feet 8 inches wide, did some excellent work in this contest. The severest test of all was the hill-climbing contest, the Stanley steam carriage leading, followed by the Whitney steam carriage. The Riker electric carriage reached over 62 feet in three trials, the Stanley steam carriage making but one trial on a rush, and covering a distance of 80 feet in 4 3-5 seconds. The prizes will be awarded and announced later.

PHILADELPHIA NOTES.

MR. C. W. KENNEDY, who, jointly with Messrs. Frank A. Pocock and Ralph Ashley, invented an electric vehicle which was exhibited at the Philadelphia Electrical Exhibition last June, is fitting up a factory at 3728 and 3730 Mt. Vernon street, this city, where electric carriages, delivery wagons and launches will be manufactured. An illustrated description of this vehicle was

published in The Electrical World of June 25, among the notes of the electrical exhibition.

THE FRANKLIN ELECTRIC SUPPLY HOUSE, 506-508 Cuthbert Street, Philadelphia, of which Mr. H. P. Feister is proprietor, is sending out to the trade a card expressing thanks for the liberal patronage extended to this new concern, which was started on July 1 last. The enterprise was launched with a "few wagonloads of goods," and the business has grown to such an extent in this short time that there is but little in the electrical line that this house cannot supply. It has made arrangements with the best manufacturers for the sale of their products.

FRANKLIN INSTITUTE.—At the stated meeting of the chemical section of the Franklin Institute, held on the evening of November 16, Mr. George D. Burton, of Boston, read a paper on "The Burton Electric Process of Unhairing and Tanning Skins." The process was exhibited in practical operation at the meeting. On the evening of November 22 Mr. A. J. Wurts will read a paper before the electrical section on the subject of "Lightning and Lightning Arresters," and will make experimental demonstrations, and before the same section, on the evening of December 13, Prof. Arthur J. Rowland will read a paper on "Commercial Photometers and Light Standards."

THE ANNUAL MEETING of the Electrical Trades Association was held on the evening of November 4 at Soulas' Café in this city. An excellent bill of fare was served, and an enjoyable and profitable time was spent by those who were present. The entertainment included vocal and instrumental music, and remarks were made by several gentlemen. The old officers were unanimously re-elected, as follows: Charles E. Trump, of the Novelty Electric Company, president; C. M. Wilkins, of Partrick, Carter & Wilkins, vice-president; W. H. Hollar, secretary and treasurer; Miss E. A. Symms, assistant secretary; Frank D. Sweeten, A. Bournonville and H. G. Kepler, executive committee. Other gentlemen present at the meeting and dinner were: E. W. Wilkins, of Partrick, Carter & Wilkins; G. A. and G. W. Vallee, of Vallee Brothers & Co.; H. C. Roberts, of the H. C. Roberts Electric Supply Company; George F. Klemm, of Klemm & Co.; Frank H. Stewart, of Frank H. Stewart & Co.; I. C. Walker, of Walker & Kepler; L. P. Clark, of L. P. Clark & Co.; Winford Lewis, of the Novelty Electric Company, all of Philadelphia, and A. N. Palmer, of A. N. Palmer & Co., Baltimore.

"THE STATUS OF ELECTRICAL INVENTION" was the title of a paper read before the electrical section of the Franklin Institute on November 8, by Mr. William A. Rosenbaum, patent solicitor, of New York. The speaker treated the question somewhat from the standpoint of the patent lawyer in that he adapted the technical meaning of the word "invention" instead of its popular meaning. Each of the main branches of the science of electricity was taken up in turn, and the inventions therein referred to and described which have been responsible for, or have directed the lines of, its development. Thus, in the building up of a branch of the art, certain inventions appear from time to time, from which spring new lines of development or improvement, and these, which the speaker termed the "milestones in the progress of invention," were briefly described and the proper places in the art located. This material will no doubt be useful to future investigators. The paper closed with the prophecy that, "wireless" telegraphy now being a fact, we shall ere long be able to telephone without wires, have electric lights without wires, ride in electric cars propelled by electricity delivered thereto from a stationary dynamo without connecting wires, and transmit electric power, in general, without wires.

Buffalo and Niagara Falls Notes.

IT IS EXPECTED that the new electric power house in Buffalo to be used for lighting the city will be started up in a small way during the week. Probably a single arc-light circuit will be tried at the start.

THE NIAGARA power current is reported to have weakened at Lockport one day this week, so that the cars and lights threatened to wait a while, but without explanation the current resumed full force after a little time. It is reported that something went wrong at the power house end of the line, although there was no interruption in Buffalo. In fact, this line has been operated practically without trouble since the time it was inaugurated.

THE ENTIRE PLANT of the Niagara Power Company's system, from the discharge of the tail-race of the wheel-pit to the further extremity of the wires, is said to have cost about $7,000,000. The 50,000 horse-power reported to be now in use is about twice the actual amount, all but a very small amount of the power being used in the operation of new factories and trolley plants. This does not include the 10,000 horse-power in use at the Schoellkopf plant in the gorge at Niagara.

THE BELL TELEPHONE COMPANY, of Buffalo, is making a long record for the laying of subways for the burying of its wire service in the city. For a while it was hard for it to take up the burying of the wires, and it was slow to obey the strict mandates of the city, but it is now many miles ahead of the requirements, having laid about 20,000 feet of ducts during the season just closed. In fact, it is said by outsiders that the company is expending all over a very moderate income in this and other classes of improvements. The best showing of all, however, is the new work done by the company in the rural districts of western New York. Not only are the towns along railroad lines connected, but the lines are crossing from one road to another. The opening of a line from Brockport, on the New York Central, between Rochester and Niagara Falls, and Hamlin, on the Rome, Watertown & Ogdensburg, to the north is just announced, and there are many new towns in Wyoming and Livingston counties lately connected. The encouraging part of this latter work is that it shows a better financial condition of the rural districts, which have so long been in anything but a promising condition. If the farming districts continue to improve they will not only soon be covered with a network of electric wires, but the agitation in the agricultural press for farm telephones will soon be carried into effect.

Chicago Note.

MR. GEORGE W. PATTERSON, 1539 Marquette Building, Chicago, reports a great demand for his "Jubilee Souvenir; History of the Spanish-American War, with Handy Atlas Maps," and now extends a cordial invitation to those handling or using American Circular Loom flexible conduit, Boston Electroduct steel tube, Gordon or Law primary batteries, Welsbach or New Era electric gas lighters or Standard knife switches to call at his office and secure a copy of this excellent work.

St. Louis Notes.

REMOVING POLES FROM THE STREETS.—The Missouri Edison Electric Company has a force of men at work removing 1500 poles from the streets of St. Louis. All trace of the old overhead wires of the company will soon be removed.

PROPOSED MUNICIPAL ELECTRIC LIGHT PLANT.—It is probable that the Board of Public Improvements will send an ordinance to the Municipal Assembly, providing for a municipal electric light plant. President McMath has expert assurances that such a plant could be erected by January 1, 1900, when the present contract expires. The board is forced to this alternative by the persistency of the Council in filing bills for letting a lighting contract. If the Council turns down the municipal ordinance, then the board will have to let a temporary contract.

PEOPLE'S RAILWAY SALE.—The decree in the suit of Louis M. Rumsey et al., against the People's Railway Company was approved and ordered filed by Judge Wood in the Circuit Court last week. The indebtedness of the defendant company is set forth as follows: Taxes and assessments, $24,453.72; first and second bond issues, aggregating $200,000; coupons on third mortgage bonds; special tax, $15,000. Charles C. Maffit is appointed special commissioner and is ordered to receive no bid for less than $200,000. The proceeds of the sale will be devoted to the payments of costs of court, taxes, coupons and principal of third mortgage bonds. What remains goes to the heirs or assigns of the defendant company. Mr. Maffit is directed to sell the road in sixty days.

FIGHTING THE JULIAN LAW.—The St. Louis & Suburban and St. Louis & Meramec River Railroad companies made return to the petition for a writ of injunction filed a few days ago in the Circuit Court. The petition for an injunction was filed by the Cass Avenue & Fair Grounds Railway, basing its claim upon the "Julian law," approved April 9, 1895. The defendants in their answer say the "Julian law is null and void," and cite the statutes. The answer also accuses the plaintiff of having acted in bad faith, and not according to the principles of equity, and therefore the defendants were precluded from obtaining a temporary or permanent writ of injunction even if the Julian law be valid. The answer is long, and recites other instances of confliction between the Julian law and the constitution. Thus far, the defendants allege, they have expended $5,839.86 in the laying of tracks and construction along four squares on Fourth Street.

Pacific Coast Notes.

THE PRINEVILLE (OREGON) TELEPHONE COMPANY is expecting to extend its lines to The Dalles, via Antelope and Sherar's Bridge.

THE MARKET STREET RAILWAY COMPANY, San Francisco, has filed a petition to be permitted to use electricity on several streets which it now covers with a horse-car system. Some changes may have to be made in the routes, however, to avoid double tracking in the wholesale district.

AN OPPOSITION TELEPHONE COMPANY, to be backed by Rudolph Spreckels, who recently realized a million or more by selling his interest in the Hawaiian Commercial Company, will, it is reported, be established in this city. The story goes that Mr. A. C. Henney, a Guatemalan inventor, has a telephone on which he has obtained patents in several European countries, and which can be constructed at less cost than the Bell instruments. Mr. Spreckels denied that he would become interested in a company.

MR. L. D. TANDY, a representative of the General Electric Company, of Schenectady, N. Y., has been in Oakland, Cal., for several weeks studying the Southern Pacific Railroad Company's local and suburban system of handling passenger traffic in connection with the Oakland-San Francisco ferries. He will report to C. P. Huntington—who favors an electric system—as to the feasibility of substituting trains of electric cars for the present trains drawn by steam locomotives. Local officials do not consider the prospects good for handling the heavy traffic by electric cars.

MR. J. H. THATCHER, superintendent of the Oregon Telephone & Telegraph Company, recently received from General Manager Sabin, of the Sunset Telephone Company, instructions to take immediate steps to connect all of the towns in Tillamook and Clatsop counties with the Pacific Coast system, controlled by the Sunset Company. About 125 miles of new pole lines must be built, and 6000 poles will be required. The new line will probably be extended via Forest Grove and North Yamhill to Nehalern, and thence up and down the coast to Astoria and Tillamook. Preliminary work will be begun at once.

Canadian Notes.

A BY-LAW to provide $6000 for the purchase of an electric light plant for the town of Acton, Ont., has received the sanction of the ratepayers. Arrangements will be made immediately for the installation of the plant.

THE ELECTRIC STREET RAILWAY COMPANY of Toronto, Ont., has decided to make an experiment in the matter of smoking cars, and will run cars on certain lines during certain hours of the day in which smokers will be allowed full privileges.

IN THE CITY OF HALIFAX, N. S., a special committee has been obtaining information as to the advisability of the city undertaking its own street lighting, and as a result the city electrician and engineer have been instructed to prepare plans and invite tenders for a suitable plant.

SEALED TENDERS will be received by the Department of Railways and Canals at Ottawa, until November 21, for the construction of a power house and the installation of electrical power for operating the locks, bridges and other structures of the Soulanges Canal, and for lighting the canal throughout.

PROF. R. B. OWENS, the new professor in charge of the electrical department of McGill University, Montreal, is introducing a new feature which will be of great value not only to the students but will also confer great benefits upon the general public. This will be a standardizing laboratory. There will be a room devoted to high-potential machinery, where a voltage of 200,000 will be obtainable. There will be machines of the various types, and new types of high-tension transformers and alternating-current machinery are being installed.

WITHIN another year Quebec city, it is said, will be one of the best lighted cities in the world. It will have no less than three companies converting water powers in the vicinity into electricity. They will be the Montmorency Falls Company, the Chaudiere Company, now in course of formation, and the Jacques Cartier Water Power Company, which has already commenced to build at the falls of Jacques Cartier River in Valcartier, some 18 miles from the city of Quebec. This company will also build large pulp and paper mills at the falls.

THE MOST startling offer for the supply of electric power yet made in the city of Toronto, Ont., was among the tenders received by the Board of Control of that city this week. A company has put in a tender to light the city streets and supply energy for manufacturing purposes at the rate of 1c. per horse-power per hour. Its capital, it states, will be $5,000,000, and when the dividends reach 10 per cent. it offers to light the streets at cost price. It will also establish a manufactory of electrical supplies, and the profits of this will come under the same agreement.

OFFICIAL OPENING OF THE TRANSMISSION PLANT of the Cataract Power Company of Hamilton, Limited.—On Saturday, November 12, the formal opening of the 20,000-volt, 35-mile power transmission system between Decew Falls and Hamilton, Ont., was celebrated by a visit of the officers, engineers, stockholders and visitors from Hamilton and neighboring places to the power house. The party numbered about 200. After inspecting the system refreshments were served in the wheel and generator room. The toasts and speeches evidenced a strong local patriotism and pride in this Canadian development of Niagara power, for such it really is. On the return the party visited the step-down transformer station.

General News.

THE TELEGRAPH AND TELEPHONE.

GREENSBURG, KY.—The Green County Telephone Company has been incorporated with a capital stock of $3500.

KENTON, OHIO.—The Kenton Telephone Company, with $30,000 capital, has been incorporated to operate a telephone system from Kenton to Marion, Marysville, Bellefontaine, Wapakoneta and Lima. The incorporators are Ed. L. Barber, James S. Brailey, J. C. King, C. E. Guilford and Horton Park.

SUFFOLK, VA.—A charter has been granted to the Isle of Wight Telephone & Telegraph Company. It authorizes the erection of a telephone line between Suffolk and Smithfield. It will connect here with the Southern States Telephone Company. The officers are: J. W. Thomas, Smithfield, president; J. U. Burgess, Suffolk, vice-president; J. W. Holloday, Smithfield, secretary and treasurer; W. N. McAnge, Suffolk, general manager.

COLUMBUS, OHIO.—The Ohio Telephone Company has been incorporated with a capital stock of $100,000. The incorporators are Messrs. R. E. Jones, T. A. Simons, David C. Beggs, F. D. Simons, Howard Park, Captain L. D. Myers and William C. Orr. The corporation is formed for the purpose of constructing, building and acquiring in the State of Ohio and elsewhere lines of telephone and carrying on the telephone business. The main office of the company will be located in Columbus.

CANANDAIGUA, N. Y.—The Empire State Telephone Company has abandoned several of its lines in this county, taking out the instruments from a number of offices and cutting the wires. The offices thus closed are Bristol, Bristol Centre, East Bloomfield, West Bloomfield, Bristol Springs, Naples, Honeoye, Reed Corners, Rushville, Miller Corners, Middlesex and Vine Valley. This action, it is stated, was taken to avoid litigation with certain farm owners along the roads through which the company's poles are erected and wires strung.

ELECTRIC LIGHT AND POWER.

SANTA FE, N. M.—An electrical generating plant is to be built at Cochiti to be run by water power, and which, it is thought, will supply the entire camp with power.

CAMDEN, N. J.—The Citizens' Light, Heat & Power Company has been incorporated to manufacture electricity for light, heat and power. Capital, $100,000. Incorporators: Andrew S. Scull and Joachim R. Moon, of Camden, N. J.; Wesley Bartine, Philadelphia.

ROCHESTER, N. Y.—Papers incorporating the Rochester Electric Service Company of Rochester have been filed with the Secretary of State. The new concern is capitalized at $1000. Its objects are stated to be to manufacture electricity for light, heat and power in Rochester. The directors for the first year are: John W. Cook, Jr., Frederick Fish, Miner S. Horton, George B. Newman, all of Rochester.

TRENTON, N. J.—The movement for the formation in Trenton of a new electric light company, with a plant to be operated by the waters of the Delaware through the erection of a dam on the Pennsylvania side of the river, is being pushed successfully forward, and has reached that state of development which means the absorption of the existing electric light company. Colonel A. R. Kuser is one of the active men in the new company now being formed.

THE ELECTRIC RAILWAY.

OSWEGO, N. Y—Oswego will have no street-car service of any kind for the next month or six weeks. Justice Wright at Rome has granted an order on motion of N. S. Bentley, attorney for Receiver Tidman, allowing the closing of the entire road until the completion of the pavement in East Bridge Street.

MIDDLETOWN, N. Y.—The Middletown-Goshen Traction Company has passed into the hands of a receiver. W. B. Royce, of this city, was appointed sole receiver of the company by Judge Roger A. Pryor. It is a voluntary dissolution on the part of the company, the application being made by President McKeige.

JERSEY CITY, N. J.—Mayor Hoos has signed an ordinance granting a franchise to the North Hudson County Railway Company to operate the cars on the Grove Street line, connecting Jersey City with Hoboken, with electricity, instead of horse-power. The franchise is perpetual, and the company agrees to pay the city $600 a year.

MIDDLEBORO, MASS.—Another street railway company is being formed to build a road to connect the New Bedford, Middleboro & Brockton line, through Lakeville and East Taunton, with Taunton. It will be known as the Taunton & Middleboro Street Railway Company, with capital stock of $55,000. The route selected is from Middleboro town house, through Precinct village to East Taunton, to the terminus of the East Taunton street railway in that village.

PERTH AMBOY, N. J.—The municipal authorities have granted a franchise for the construction of a trolley road to run through the city. It is the purpose of the projectors of the company to form connections with the Consolidated Traction Company by which direct communication with the surrounding country can be had. The officers of the company are: President, Leonard Lewisohn; vice-president, C. J. Wittenberg; secretary and treasurer, J. C. McCloy.

LEGAL NOTES.

FREIGHT ON STREET RAILWAYS.—Judge Prentice of the Superior Court at Hartford, Conn., on November 8 denied the application of the city of Hartford for an injunction to restrain the Hartford Street Railway Company from transporting freight through the streets of the city. The judge says that this right was granted in the legislative act on street railroads adopted in 1893, that act reading that street railways may transport persons and property, including merchandise.

THE ENCLOSED ARC LAMP.—Following is a copy of the final decree of Judge Lacombe, of the United States Circuit Court for the Southern District of New York, dated November 5, in the case of the Marks Enclosed Arc Light Company, complainant, against the Electric Construction & Supply Company, Fred. A. Kinsman and Charles E. Rocap, defendants, and in favor of the complainants:

Upon the annexed consent and the bill of complaint herein, and the defendants having settled with the complainant for the profits heretofore realized by the defendants from the manufacture (but not from the use) of the lamps made by them and for all damages heretofore realized from the sale (but not from the use) of the said lamps heretofore made by the said defendants and for the costs and disbursements of this action, it is ordered, adjudged and decreed:

1. That the complainant, Marks Enclosed Arc Light Company, is a corporation duly organized and existing under and in pursuance of the laws of the State of New York, and is the owner of United States letters patent No. 520,996, granted to Louis B. Marks and Clarence Ransom for certain improvements in electric arc lamps, dated June 5, 1894, and of all the exclusive rights therein and thereby granted and secured.

2. That the said United States letters patent No. 520,996 and claims 1 and 2 thereof are good and valid letters patent.

3. That the defendants, Electric Construction & Supply Company, Fred A. Kinsman and Charles E. Rocap, confederating with others, have infringed and have caused to be infringed the said letters patent No. 520,996 and claims 1 and 2 thereof, and each of them, by making, using and selling electric lamps known as the "Kinsman" lamps, and by making said lamps and selling them to their customers for use, with the knowledge and intent that the same were to be used in infringement of said letters patent No. 520,996, and in infringement of claims 1 and 2 thereof, and with the knowledge and intent that their customers in using the said lamps would practice and employ the methods set forth and claimed in claims 1 and 2 of said letters patent No. 520,996.

4. That an injunction issue herein directed to the said defendants, Electric Construction & Supply Company, Fred. A. Kinsman and Charles E. Rocap, perpetually enjoining and restraining the said defendants, their officers, employees, agents, servants, clerks and attorneys, and all persons acting under them or their authority, or in privity with them, and each and all of them, from infringing the said letters patent No. 520,996, and particularly from infringing claims 1 and 2 thereof; and from making, using, selling, offering for sale, or causing to be made, used, sold or offered for sale, any electric arc lamps embodying or employing in their operation or use the method or methods set forth in claims 1 and 2 of said letters patent, and from making, using, selling or offering for sale, or causing to be made, used, sold or offered for sale, any electric arc lamp like or substantially like the lamp heretofore sold and offered for sale by the defendant Electric Construction & Supply Company, variously described by the defendants as the "Kinsman" Lamp, the "Kinsman 150-Hour Lamp" and the "Kinsman Long Burning Arc Lamp.

PERSONAL NOTES.

MR. R. E. INSKEEP is receiving congratulations on the fact that he has been appointed general manager of the Akron Electrical Manufacturing Company, of Akron, Ohio. Mr. Inskeep has been doing good work for the company for some time, and well deserves the promotion.

MR. W. F. D. CRANE, of the Porto Rico Construction Company, is at present in New York on a business trip. Mr. Crane is enthusiastic over the electrical possibilities of Porto Rico, and says that much work in the line of electric railways and power transmission will shortly be undertaken there.

MR. CYRUS O. BAKER, JR., is so well known to readers of THE ELECTRICAL WORLD that a reproduction here of his latest photograph and a few words regarding him will be welcome to many. Mr. Baker was born in Newark, N. J., on October 12, 1857, and acquired his education in the same city. He received a special training in metallurgy, particularly as applied to the rare and precious metals. He is senior member of the firm of Baker & Co., whose platinum products are so extensively used in the electrical arts and industries, especially in the manufacture of incandescent lamps. This firm believes that it is entitled to the unique distinction of being the only refiner of crude platinum on this hemisphere. Mr. Baker is of an enthusiastic nature, and believes in the advancement of all legitimate means to promote good fellowship and closer community of interests among those engaged in electrical pursuits. He was one of the incorporators of the old Electric Club of New York, and labored faithfully in its behalf. For a number of years he has gratuitously acted as master of transportation of the National Electric Light Association, and in the fulfillment of the duties of this position has made for himself a host of friends. Mr. Baker was president of the Electrical Exhibition Company, which conducted the electrical exhibition at Madison Square Garden last May, and is a member of the New York Electrical Society, the Magnetic Club and the American Institute of Mining Engineers.

CYRUS O. BAKER, JR.

OBITUARY NOTE.

MR. LATIMER CLARK, the well-known electrical engineer, died suddenly at his residence in Twickenham, London, on the morning of October 30. Mr. Clark was born at Great Marlow on March 10, 1822, and was, therefore, seventy-six years of age at the time of his death. He is known to the electrical fraternity all over the world mainly through his connection with submarine telegraph enterprises and the construction of submarine cables. He introduced many improvements in the English telegraph system, and in 1860 a report by him on the subject of underground telegraph wires was prepared and was embodied in the government report on the subject in 1861. In 1860 he was nominated a member of the committee jointly appointed by the government and the Atlantic Cable Telegraph Company to inquire into the whole subject of submarine telegraph cables. His work in this connection was very valuable and embodied the researches and experiments that had been made up to that date. In the same year he went into partnership with Sir Charles Bright and for ten years after carried on extensive work in the construction and laying of submarine cables. Mr. Clark was the inventor of the well-known standard cell which bears his name, and was author of several important contributions to scientific literature. His "Elementary Treatise of Electrical Measurements" has been the standard work on this subject since the time of its appearance, in 1868. Mr. Clark was a fellow of the Royal Society and past president of the Society of Telegraph Engineers and Electricians, having held the office of president in the year 1875 before the change of name. Mr. Clark's remains were buried on November 3.

Trade and Industrial Notes.

THE FOSTORIA INCANDESCENT LAMP COMPANY has opened an office in the White Building, 95-97 Liberty Street, New York City, which is in the charge of Mr. H. Stillson Hart as Eastern representative. This will also be the Eastern office of the Crouse-Tremaine Carbon Company, of Fostoria, Ohio.

MR. CHARLES WIRT, 1028 Filbert Street, Philadelphia, has secured additional space, which will be devoted to the manufacture of the Wirt rheostats. These are becoming favorably known on account of the neat appearance which they present, and the close graduation made possible by the large number of steps incident to the peculiar construction used.

HOISTING APPLIANCES.—The Case Manufacturing Company, Columbus, Ohio, in issuing its latest catalogue of hoisting appliances, calls attention to the latest design of its three-motor electric traveling cranes and locomotive crane, actual applications of which are illustrated. The three-motor traveling crane is especially adapted for power houses, railroad erecting shops and foundries where heavy lifting is necessary. The catalogue contains a brief description of these types of cranes.

THE SHELBY ELECTRIC COMPANY, Shelby, Ohio, has made an arrangement with the L. M. Rumsey Manufacturing Company, of St. Louis, Mo., by which a stock of "Shelby" lamps will be carried in St. Louis, and the large corps of traveling representatives of the L. M. Rumsey Manufacturing Company will offer it for sale in all parts of the West and Southwest. As this company is one of the largest jobbing houses in the country and has a wide reputation for handling nothing but high-grade articles, both parties connected with the transaction have reason to be congratulated, as the arrangement will certainly be the means for starting a large trade in this lamp throughout the Western territory.

THE DIAMOND METER COMPANY, Peoria, Ill., has mailed to the trade a circular letter containing the announcement that it has purchased all of the machinery, stock and material of the Diamond Electric Company, and will continue the manufacture of Scheeffer wattmeters and Scheeffer transformers, aiming to retain the quality and high efficiency for which these instruments are known. The new company states that it has no connection whatever with the Diamond Electric Company, and is prepared to promptly fill all orders for its meters and transformers. The officers of the new company are E. H. Couch, president; A. B. Fink, secretary and manager; W. F. Heyle, treasurer; G. A. Scheeffer, superintendent.

THE B. F. STURTEVANT COMPANY, Boston, Mass., in its October Bulletin—F—brings prominently to the notice of the electrical trade the principal features of its direct-current motors and generators. These machines are of the bipolar and multipolar types, and of medium speed. In the motors, the bipolar machines are made in seven sizes, ranging in capacity from 1 to 15 horse-power; the multipolar motors are made in nine sizes, ranging from 9 to 125 horse-power. The bipolar generators are made in seven sizes, ranging from 1 to 12½ kilowatts, and the multipolars from 7½ to 80 kilowatts, nine sizes of the latter type being listed. These machines, as illustrated in the bulletin, have the appearance of being massive and compact, and are evidently well designed.

THE SCHMIDT & BRUCKNER ELECTRIC COMPANY, 211 Greenwich Street, New York City, reports that it is receiving many orders from all parts of the country for its new adjustable telephone arm, which is described and illustrated elsewhere in this issue. The company is branching out into many specialties, both as regards interior and exchange apparatus, and invites an inspection of its products and its manufacturing facilities for turning out fine work. It makes a specialty of selling transmitters separately, and reports that the demand for these instruments is continually increasing on account of their ability to withstand the wear and tear of telephone service. The company states that it will be pleased to send a sample of its new telephone arm or other parts to any one desiring to investigate its apparatus. A copy of a handsome "poster" will be mailed on application to the company.

A NEW SECTIONAL CONDUCTOR RAILWAY SYSTEM.—That the closed conduit sectional conductor railway system is to find a successful field seems to be the growing opinion among the manufacturing companies. The Johnson Company, of Lorain, Ohio, is working steadily in this line, as is evidenced by patent No. 613,794, issued November 8, 1898, to W. M. Brown and assigned to this company, this patent covering improvements on the previous designs of the same inventor. The switch as described is operated by an electromagnet carried on the car, the switch obtaining a frictionless pivot by floating on mercury and giving a double break on opening, one between the switch and the contact rail and the other between the switch and a mercury terminal. One end of the switch mechanism is grounded in the open position, so that should a connection or an arc be held across the openings the fuse supplying that switch would be blown.

THE CHICAGO RHEOSTAT COMPANY, 1649-1650 Marquette Building, Chicago, has just issued a very complete and handsomely gotten-up catalogue of its manually-operated and self-starting motor rheostats and dynamo field rheostats. Some very clear half-tone illustrations of the various types of apparatus produced by this company give an excellent idea of their construction, which embodies interesting electro-mechanical features. The principal points of the automatic starter, the overload starter, the plain speed regulator, the automatic speed regulator and the overload speed regulator, are pointed out, and the self-starting rheostats are similarly treated. The catalogue includes a very comprehensive telegraph code to facilitate ordering by wire, and instructions are given for guidance in wiring and operating the apparatus. The design and workmanship of this company's rheostats are the result of several years' experience in this line of manufacture, and represent the most advanced engineering practice.

THE JULIUS ANDRAE & SONS COMPANY, Milwaukee, Wis., manufactures a line of telephones and electrical supplies which command favor in the electrical trades. In a catalogue just issued the various types of telephone apparatus manufactured by this company are illustrated and concisely described. The object of this company has been to approach as nearly as possible perfection in telephone apparatus, and to this end it has employed busy brains and clever fingers. It is with confidence, therefore, that it offers its products to the trade as the most carefully made instruments that capital, mechanical skill and energy can produce, and claims that its telephones are mechanically and electrically perfect. Among the illustrations presented in the catalogue are the Andrae standard instruments embracing exchange sets of various designs, long distance desk telephone fitted with Ericcson coal-grain microphone and double-pole receiver, long-distance swinging arm desk set, and intercommunicating sets. The Standard No. 9—an exchange and long-distance instrument—is fitted with the company's improved Andrae carbon transmitter and single-pole receiver. The magneto bells are wound to 40,000 ohms for bridging service and 10,000 ohms for regular exchange service. Besides these instruments there are listed and illustrated switchboards, magneto bells, receivers, extension bells, testing bells, etc., and a complete line of telephone line construction supplies. This concern is now in its thirty-ninth year.

THE MONTAUK MULTIPHASE CABLE COMPANY, 100 Broadway, New York, is making an exhibit of its interior thermostatic electric fire cables at the exhibition of the Massachusetts Charitable Mechanic Association now being held at Boston. Mr. Lucian W. Jenney, who was in charge of this company's exhibit at the Electrical Show at Madison Square Garden last May, has supervision of the exhibit in Boston. "The Scientific Australian," which is published in Melbourne and Sydney, Australia, in a recent issue gives an account of a test in Melbourne of a new fire-alarm apparatus in which the Montauk multiphase cable was used. The continuous thermostatic properties of the cable were demonstrated to the great satisfaction of those who witnessed the trial, and the usefulness of this cable in conjunction with the apparatus tested on this occasion was very successfully shown. At the annual convention of the International Association of Fire Engineers, which was held in St. Louis last October, a demonstration was made by Chief Bosch, superintendent of the fire-alarm telegraph system of Newark, N. J., of the application of the Montauk multiphase automatic fire detective cable to the auxiliary fire-alarm system. The exhibition, it is said, demonstrated to the convention the

benefits and advantages of the use of the auxiliary fire-alarm system in conjunction with the fire detective cable. It was shown that the cable is absolutely and solely a thermostat, the application of the flame of an ordinary match thereto causing the alarm to sound.

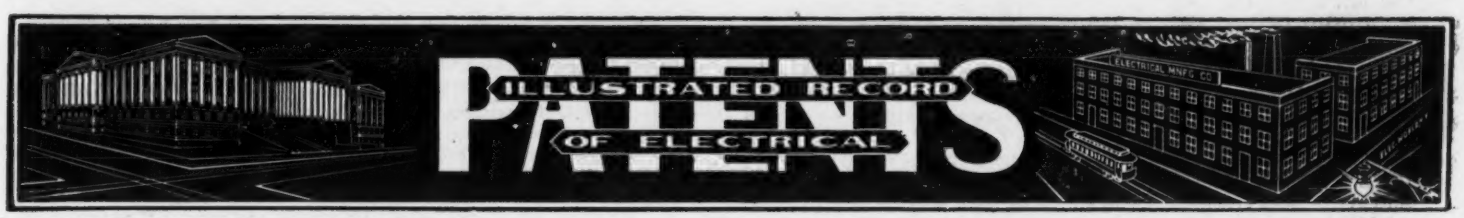
COCHRANE FEED WATER HEATERS AND PURIFIERS.—Among the recent sales of Cochrane feed water heaters and purifiers the Harrison Safety Boiler Works, Philadelphia, report the following: The A. I. Root Company, Medina, Ohio, 300 horse-power, special; Wapakoneta (Ohio) Electric Light & Power Company, 425 horse-power; Latrobe Steel & Coupler Company, Melrose Park, Ill., 1000 horse-power; the Monessen (Pa.) Steel Company, 1250 horse-power; Fish Brothers Wagon Company, Racine, Wis., 500 horse-power; National Tube Works Company, McKeesport, Pa., 3000 horse-power; Cherry Valley Iron Company, Leetonia, Ohio, 1750 horse-power; Delaware & Hudson Canal Company, Olyphant, Pa., 2500 horse-power; Edwardsville (Ill.) Electric Light & Power Company, 150 horse-power; Raritan Copper Works, Perth Amboy, N. J., 1000 horse-power. Recent sales of Cochrane separators include the following: George V. Cresson Company, Philadelphia, 7-inch horizontal; Compania Cervecera, Toluca, Mexico, 6-inch horizontal; Ashland (Ky.) Steel Company, 4-inch horizontal; A. A. Sanborn, Boston, 10-inch horizontal; Johnstown & Gloversville Gas Company, Gloversville, N. Y., one 3-inch and one 4-inch horizontal; Simonds Manufacturing Company, Chicago, 5-inch vertical; United States Navy, 4-inch horizontal; Standard Oil Company, Whiting, Ind., three 6-inch oil-ammonia; Boston & Maine Railroad, two 6-inch horizontal; Massachusetts Institute of Technology, Boston, 8-inch horizontal; Barr Pumping Engine Company, Boston, 5-inch horizontal; Beaver Traction Company, Beaver, Pa., one 12-inch and one 5-inch vertical; George F. Blake Manufacturing Company, Boston, 4-inch vertical and one 3-inch vertical; Shenango Valley Steel Company, New Castle, Pa., 12-inch horizontal; Hoopeston (Ill.) Electric Company, 6-inch horizontal; Southern Electric Railroad Company, St. Louis, Mo., 12-inch horizontal; Chicago Brass Company, Kenosha, Wis., 6-inch vertical; Mystic (Conn.) Electric & Gas Lighting Company, 5-inch vertical; De La Vergne Refrigerating Machine Company, New York City, 5-inch horizontal oil-ammonia.

THE ENCLOSED ARC LAMP.—It was not until Mr. Louis B. Marks' invention of the enclosed-arc method of operation, in 1894, and his elaborate investigations into the adaptation of carbons for this purpose that the closed-globe arc-lamp problem was solved. Then there were no enclosed lamps in general use in any country in the world. To-day they are extensively used in every civilized country on the globe. They have not only displaced the old-style open-arc lamps, but have opened up new fields for arc lighting which could not previously be filled either by the incandescent lamp or by the open-arc lamp. Within the brief space of four years this new industry has sprung up, and over 75,000 lamps of the enclosed-arc type, all designed and operated in accordance with the broad claims of the original Marks patent (No. 520,996), June 5, 1894, have been sold in this country alone. Add to this number the many thousands that have been sold in Great Britain, France, Germany, Canada, South America, etc., and it is safe to say that over 100,000 of these lamps are now in daily use. The revolution created by the advent of the enclosed-arc lamp may truly be said to be unparalleled in electric-lighting annals, not even excepting the incandescent lamp itself. The first two claims of the Marks patent No. 520,996 are as follows: 1. The method of operating an arc lamp on constant potential circuits, which consists in confining the arc within an enclosure, restricting practically all the drop of potential in the arc circuit to the arc and continuously maintaining said drop at a point which prevents an excessive flow of current. 2. The method of operating an arc lamp, consisting in confining the arc within an enclosure from which the air is excluded or to which it has difficult access, and maintaining a long arc to produce a larger than normal drop of potential, whereby an arc light of normal intensity may be maintained by an amperage lower than normal. In THE ELECTRICAL WORLD of October 29 last was published a brief reference to the decision of Judge Coxe in favor of the Marks Enclosed Arc Light Company, in its suit against the Washington Mills Company, New York, which used General Electric lamps, and among the legal notes in this issue is given the final decree of Judge Lacombe in the case of the Marks Enclosed Arc Light Company against the Electric Construction & Supply Company, Fred. A. Kinsman and Charles E. Rocap, in favor of the complainant.

Business Notices.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 9-15 Murray Street, New York City.

THE BATTLESHIP WISCONSIN will be launched in San Francisco, Saturday, November 26. The official train carrying State officials and the christening party will start from Marinette, Milwaukee and Chicago, Saturday, November 19, going via the Chicago, Milwaukee & St. Paul Railway. Stops will be made at St. Paul, Tacoma, Portland, San Francisco, Los Angeles and Denver. Pullman palace sleeping cars, dining cars, observation cars for the exclusive use of the party for the entire trip, under the direction of Mr. Reau Campbell, general manager of the American Tourist Association. A limited number of tickets at reduced rates, covering all expenses, will be sold; they include railway and sleeping car fares, meals in dining cars, hotels, carriages, etc. For details address the American Tourist Association, 1124 Marquette Building, Chicago.



UNITED STATES PATENTS ISSUED NOVEMBER 8, 1898.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

613,647. INSULATOR FOR INCANDESCENT ELECTRIC LAMPS; C. W. Brown, of Boston, Mass. App. filed Dec. 15, 1897. The described reversible insulator formed of non-conducting material internally threaded, having about centrally a thickened peripheral ring, and at either side thereof thinner end portions projecting longitudinally from and of less diameter than said ring. (This patent was issued November 1.)

613,663. CONNECTOR; F. E. Case, of Schenectady, N. Y. App. filed Aug. 5, 1898. As a new article of manufacture, a terminal having a longitudinal slot, a screw and a pin in line with the slot, and a depression in the back of the terminal at the end of the slot.

613,669. BRUSH HOLDER; A. E. Doman, of Elbridge, N. Y. App. filed Feb. 4, 1898. In a brush holder, the combination of a frame or support provided with a concave socket and brush clamp, provided with a convex projection having a substantially universal movement in said socket, substantially as described.

613,688. ELECTRIC SWITCH; F. A. La Roche, of New York, N. Y. App. filed Dec. 28, 1897. In an electric switch, a bridge, plates adapted to be connected with one end of a circuit, a pivot carried by said plates, and carrying said bridge and provided with a threaded portion, an arm working on said bridge portion and directly connected with said bridge, whereby said arm moves in unison with said bridge, a means of preventing said pivot from turning in said plates, and jaws adapted to receive said bridge and to be connected with said circuit.

613,705. ELECTRIC TIMING RACE APPARATUS; J. I. McDonald, of St. Joseph, Mo. App. filed Jan. 4, 1897. A racing time apparatus, consisting of a dial, a main hand and an auxiliary hand, both co-operating with the dial, mechanism for actuating said hands, electrical devices for temporarily arresting the auxiliary hand and separate electrical devices for stopping the main hand, at will, substantially as described.

613,708. ELECTRIC RAILWAY; Jas. F. McLaughlin, of Philadelphia, Pa. App. filed May 2, 1896. In an electric railway, an exposed circuit terminal consisting of a plug in the road-bed, composed of a body portion, a removable contact face, and locking mechanism for holding the latter against accidental removal, substantially as described.

613,713. TROLLEY-POLE GUIDE-ROPE; S. R. Parks, of Central Falls, R. I. App. filed Aug. 4, 1897. The combination of a flexible tubular rope, funnel, trolley wheel and pole, substantially as described.

613,732. BICYCLE; M. J. Steffens, of Chicago, Ill. App. filed Sept. 29, 1897. In a bicycle or similar vehicle, the combination of a pulley having a periphery rounded in cross-section, means for rotating the pulley, a driving wheel having a periphery rounded in cross section, and a belt cup-shaped in cross section running around the periphery of the driving wheel and between the wheel and the ground, whereby leverage is obtained and slipping prevented, substantially as described.

613,735. ELECTRIC CIRCUIT CONTROLLER; N. Tesla, of New York, N. Y. App. filed April 19, 1898. In a circuit controller, the combination with rigid and fluid conductors adapted to be brought intermittently into contact with each other, thereby making and breaking the electric circuit, of means for imparting rotary motion to both of said conductors.

613,744. MECHANISM FOR HOLDING TROLLEYS TO THEIR WIRES; W. R. Weaver, of Covington, Ky. App. filed Oct. 9, 1897. In a trolley, the wheel and pivot rod and holders, each having an arm provided at its free end with a point, these points extending down below the horizontal plane of the immediate adjacent part of their respective arms, and adapted to be in close conjunction when the arms are closed together, and means for causing the holders to unite their arms above the conductor wire, substantially as described.

613,778. INDICATOR SIGNAL; P. Rabbidge, of Sydney, N. S. Wales. App. filed Feb. 1, 1897. The combination with a permanent magnet, of a soft-iron armature therefor, consisting of two parts, one of which is attached to one pole of the magnet and the other being adapted to slide through the other pole of the magnet toward and away from the fixed part, a button carried by the outer end of the movable part of the armature, an electric coil around the two parts of the armature and adapted to demagnetize the latter, the said armature parts acting as a core for the said coil, and means for forcing the movable part of the armature outwardly when the latter is demagnetized.

613,794. ELECTRIC RAILWAY; W. M. Brown, of Johnstown, Pa. App. filed Jan. 22, 1898. A current conveying switch having a normal position in which it is connected with one side of the circuit, and a temporary position in which it is connected with the opposite side of the circuit and with the conductor section.

613,809. METHOD OF AND APPARATUS FOR CONTROLLING MECHANISM OF MOVING VESSELS OR VEHICLES; N. Tesla, of New York, N. Y. App. filed July 1, 1898. The combination with a source of electrical waves or disturbances of a moving vessel or vehicle, and mechanism thereon for propelling, steering or operating the same, and a controlling apparatus adapted to be actuated by the influence of the said waves or disturbances at a distance from the source.

613,853. ELECTRIC REGULATOR; W. H. Chapman, of Portland, Me. App. filed March 24, 1898. In an electric regulator, the combination of a solenoid having a differential winding mounted on a tube or cylinder and having its magnetic core fitted as a piston to said cylinder, a passageway leading from one end to the other of said cylinder, and means for closing said passage way to a greater or less degree.

613,858. CAP FOR ENCLOSED ARC LAMPS; C. E. Harthan, of Lynn, Mass. App. filed April 23, 1898. In a cap for the cylinder of an enclosed arc lamp, the combination of a flange which rests on the top of the cylinder, a second flange situated below the first, a hub connecting the two flanges and acting with the flanges to form a chamber, a carbon opening in the hub, and a plurality of small chambers also formed in the hub, which surround and communicate with the carbon opening.

613,864. PHOSPHORESCENT ELECTRIC LIGHTING; D. McF. Moore, of Newark, N. J. App. filed Dec. 17, 1896. In a circuit interrupter working in a vacuous receptacle exhausted to a high degree, a supporting frame for the working parts composed of aluminum.

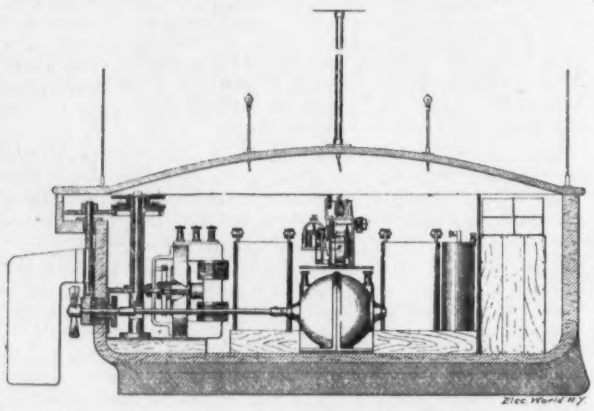
613,877. ALARM; C. A. Deal, of Chicago, Ill. App. filed July 29, 1897. An electric alarm system for banking houses and other establishments, comprising a series of levers arranged vertically below the counter, said levers being pivoted each at one end and carrying a shoe at the other, a metallic contact spring located in the path of the shoe, and plates also underneath the counter, said plates and levers being connected to wires extending from a battery and bell, substantially as described.

613,880. GENERATING AND DISTRIBUTING ELECTRIC ENERGY; C. M. Green, of Cleveland, Ohio. App. filed April 18, 1896. A method of connecting a constant-current dynamo having two or more armature circuits with two or more lamp circuits, consisting in arranging the connections so that one or more of the armature circuits of the dynamo shall be interposed between the lamp circuits and the voltage kept within safe working limits.

613,881. GENERATING AND DISTRIBUTING ELECTRIC ENERGY; C. M. Green, of Cleveland, Ohio. App. filed Dec. 23, 1896. The combination in a dynamo-electric machine, of an armature having its coils or bobbins divided into two or more successive or adjoining sets, light insulation between the individual coils or bobbins of each set and heavier insulation between the set of coils or bobbins, substantially as described.

613,882. GENERATING AND DISTRIBUTING ELECTRIC ENERGY; C. M. Green, of Cleveland, Ohio. App. filed Dec. 23, 1896. The combination with a dynamo having a series of separate armatures, of a series of external circuits corresponding with the number of armatures, said external circuits being arranged in series with the armatures and in series with each other.

613,894. DYNAMO AND ELECTRIC MOTOR FOR DRIVING VEHICLES; J. V. Sherrin, of Ramsgate, England. App. filed Aug. 17, 1896. An electric motor, comprising a driving shaft, field magnets in a frame revoluble therewith, an armature rotating on said shaft, a stationary sleeve between the hub of the field-magnet casing and the shaft, said hub rotating on the said sleeve and said shaft rotating in the said sleeve, and speed-reducing gearing connecting the armature and the field-magnet casing with the shaft, some of the gearing carried by said sleeve.

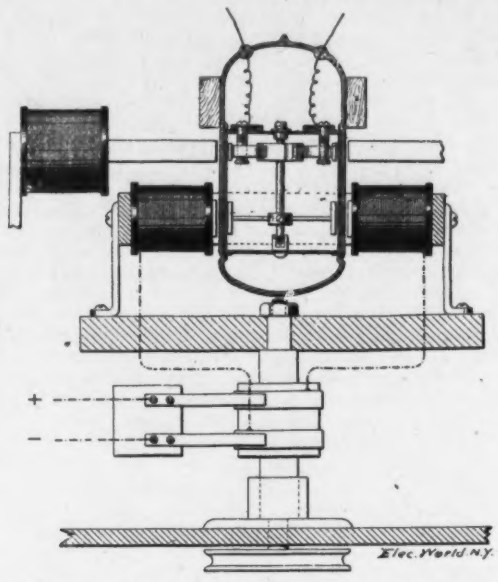


No. 613,809.—Method of and Apparatus for Controlling Mechanism of Moving Vessels or Vehicles.

613,899. INSTRUMENT FOR MEASURING ELECTRIC CURRENTS; E. C. Eldredge, of Springfield, Mass. App. filed June 20, 1898. In an instrument of the class described, a case having two binding posts thereon, one in electric connection therewith and one insulated therefrom, each of said posts having a transverse perforation near its outer extremity to receive the end of a wire, and each having a non-removable wire-binding nut thereon, substantially as described.

613,918. ELECTRIC LIGHTING SYSTEM FOR VEHICLES; R. N. Chamberlain and A. S. Hubbard, of Belleville, N. J. App. filed Feb. 17, 1898. In combination with a car and an axle thereof, said axle having inclined notches, a sectional spider surrounding said axle and having screw-threaded end portions, series of keys fitting in the notches in the axle and collars having conical bores engaging with said keys and having screw-threaded portions engaging with the screw-threaded portions of the aforesaid spider.

613,967. STATION INDICATOR; James E. Carter, of Bridgeport, Cal. App. filed Oct. 2, 1897. In a station indicator, the combination of a guide roller having a series of pins or projections thereon, a strip or band containing the names of different stations passing over said guide roller and provided with openings in which said pins or projections are adapted to fit, a spirally grooved roller in the grooves of which said pins are adapted to fit, and means for rotating said spirally grooved roller, substantially as described.

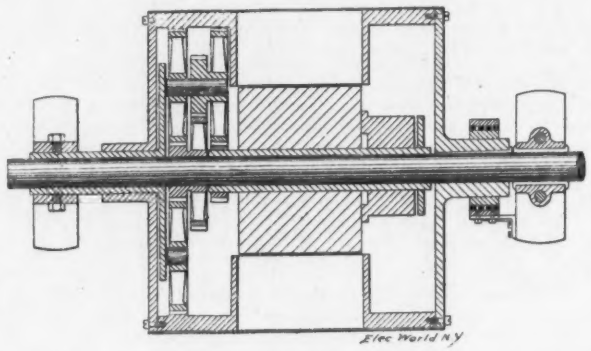


No. 613,864.—Phosphorescent Electric Lighting.

613,990. APPARATUS FOR FREEING, LIGHTING OR EXTINGUISHING GAS BURNERS; P. Guyenot, of Aix-les-Bains, France. App. filed Dec. 18, 1897. An apparatus for freeing and lighting gas burners having a burning tube, a lighting tube and a platinum wire, with a guard forming a chamber around the wire closed except at the top to keep the wire from burning in contact with the air.

614,012. PRIMARY BATTERY; C. Koenig, of Berlin, Germany. App. filed Feb. 16, 1898. In primary batteries the provision of two or more pairs of concentric elements with insulating pots between each pair and suitable exciting paste between each set of elements, all as a means for obtaining a fairly constant high-voltage current from a cell of small size, substantially as described.

614,025. BRUSH HOLDER FOR DYNAMO ELECTRIC MACHINES; G. L. Pratt, of Atlanta, Ga. App. filed June 2, 1898. The method of preventing unnecessary wear between the parts of a current-collecting device, which consists, first, in automatically making contact during the transmission of current, and secondly, automatically breaking the contact when the current is cut off, substantially as described.



No. 613,894.—Dynamo and Electric Motor for Driving Vehicles.

614,046. AERIAL ROPEWAY; J. W. White and H. White, of Widnes, England. App. filed July 8, 1898. A system of electrical traction comprising a plurality of sectional lines of carry ropes, one line being the conductor and the other the return line, rocking rails between the sections, electrical connections to alternate rocking rails of the conductor line whereby every alternate section of such line is normally a conductor, said alternate rocking rails remaining in contact with the intermediate sections of the line while the trolley is on said intermediate sections, the said rocking rails which are intermediate of those electrically connected being arranged to cut out of circuit the section of the line quitted by the trolley whereby an advancing trolley automatically cuts out of circuit the section rope which it is quitting and places in circuit, the section of line which it enters upon, substantially as described.